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BASING POWER RATES ON MOTOR CAPACITY.

The cost of supplying electrical energy to a motor installation comprises two important elements—fixed charges upon plant and the running expenses of the system devoted to power service. It is a widespread practice to make an allowance for these costs in rates by compiling monthly bills upon the basis of an energy charge recorded by meter plus either a charge based upon the measured demand or a flat rate based upon the capacity of the motor. A logical rate system takes these matters into account as a fundamental necessity in selling central-station service to motor users, barring motors of insignificant rating which can be operated upon lighting circuits without serious disturbance of voltage conditions.

Whether a customer uses the full capacity of a motor or not, the company must be ready to supply service up to this capacity, and for such readiness to serve is entitled to full compensation. An interesting case involving this principle came before the Public Utility Commission of New Jersey a year or so ago (Reilly and Manz vs. Public Service Electric Company, Report of New Jersey Public Utility Commissioners, vol. I, p. 286). It appears that this firm prior to a certain date received power service based on the maximum demand measured by the demand meter, which showed a monthly use of 6 horsepower maximum in a single motor installation rated at 15 horsepower. The concern was later put on the retail power rate of the company, under which the demand was assumed to be 80 per cent of the rated capacity, amounting to 12 horsepower in the case of the complainants. The latter alleged that the mechanical equipment in service would at no time require 12 horsepower input at the motor; that the demands of the business had been accurately tested prior to the change in method of charging; and that an assumption of use in excess of the actual requirement should not be permitted.

The use of a 15-horsepower motor was not denied, and the commissioners found in the company's favor, pointing out that a charge based on the capacity of the motor rather than on the actual consumption per month is a minimum charge whose principle should be upheld. The fact that a motor may be, in exceptional cases, in excess of the power that the customer requires, was held not to justify an order by the Board requiring departure from a general rule applicable to other customers having similar

motors. It is obvious that an installation in which the motor capacity is closely related to the load requirements yields the consumer a better rate than one operating at a load as low as the one in the case cited, not only cutting down the demand charge but also by reason of more efficient operation, using less energy. The moral of the case is the wisdom of careful motor selection and the desirability of testing the local load requirements from time to time, rather than leaving motor installations once made severely alone.

PLACING SECURITIES.

The public utility in a growing city is under the necessity of continually increasing its investment. Otherwise it cannot render good service to all of those who are ready to avail themselves of its facilities. The problem of financing extensions is ever before certain utility companies. In times when capital is plentiful, this problem may offer no serious difficulties to the utility manager. At other times and in certain places very real difficulties arise, and large discounts or commissions are sometimes allowed in order to secure the necessary funds. The practical result of this condition is that the utility pays a comparatively high rate for the additional capital, while the investor may receive little or no more than the nominal rate, the difference going to the banker or other financial agent who has negotiated the loan or sale of securities.

It is generally recognized that such an agency performs a useful function as a middleman and is entitled to compensation for his services. This is especially true where securities are widely disseminated among investors knowing little regarding the utility's affairs, since such investors often depend largely upon the judgment and advice of the investment banker in making purchases of securities. It is true, nevertheless, that such agents frequently lay an undue burden upon the utility, and enforce a commission which represents their power to dominate the situation more than it represents the intrinsic value of the service rendered.

A method of placing securities which should appeal especially to the smaller utilities was suggested by Commissioner Halford Erickson in his recent address to the Michigan Section of the National Electric Light Association. This is to dispose of securities locally as far as possible, and to reach the small investor by utilizing small denominations. While this suggestion is not entirely new, it is one which has not received the general attention which it merits. With the confidence inspired in utilities under commission regulaton, it should prove more feasible now than in the past. The bonds of public utilities would seem to afford such small investors the opportunities they are looking for provided, of course they are issued in the right amounts.

An important merit possessed by this method is its tendency toward better feeling on the part of the public toward utility corporation. When customers are also investors there is likely to be less difficulty in cultivating the good will which is such a desirable asset for the utility company.

THE ADVANCE OF THE WIRELESS.

To the heavy debt which the world already owes to wireless telegraphy further obligations are likely soon to be added, if the experiments now in progress on the Canadian Northern steamship *Royal George* are as successful as is hoped. This vessel, which left Avonmouth, England, last week, for Quebec, is equipped with a wireless direction-finder designed to enable a ship in the thickest weather, without the aid of compass or sextant, to ascertain her position when within a radius of 50 miles of a fixed radio station or of a radio-equipped vessel whose nautical position is known. It is also claimed for this apparatus, which is known as the Marconi-Bellini-Tosi system, that should the *Royal George* pick up a wireless distress signal, she would be able to set her course toward its source, even though the distressed vessel might be unable to indicate her position. The method of operation is by a system of triangular aerials and a telephonic comparison of the intensities of signals received when cutting in and out various sections of aerial designed to respond to waves from particular directions. On account of their arrangement, the triangular aerials cannot receive a message simultaneously, and the position of the sending station is not the limit of the equipment's capabilities, which are planned to include at least approximate indications of distance corresponding to the intensity of signals within the 50-mile radius.

It has been determined that within the last five years nearly 3,000 lives have been saved by wireless on the Atlantic Ocean alone, including disasters due to fire, collision, grounding, and other causes. The work of the radio engineer is constantly broadening and new applications of wireless are likely to enter many fields of transportation and remote control not now appreciated. One of these is the development of the wireless-controlled fog gun, six of which are now in service in Scotland, while one has been brought to this country for experimental service. Located on an isolated point of shore, with remote control of starting and stopping the firing, the possibilities of usefulness of this device are very considerable and the results of the experiments will be awaited with interest both in this country as well as abroad.

In the naval field, recent successful experiments in the highly specialized branch of radio work known as teledynamics, are producing remarkable results. Although as yet the technical details as closely reserved from publicity, some striking achievements in the distant control of torpedo-boat movements from shore have been effected, and it is not unlikely that many new problems in railroad signaling and train communication will occupy the attention of transportation experts within the next few years. All of this does not mean that the holder of telephone and telegraph securities should get scared and part with his bonds and shares; but it does mean that the man who wants to keep up with the times cannot afford to overlook the experiments under way and the results attained in this important and fascinating field of electrical service.

THE MOONLIGHT SCHEDULE AND ITS TROUBLES.

Economically minded municipalities which see in the moonlight schedule a solution of the street-lighting problem should take to heart the case of Monson, Mass., which is thoroughly disgusted, not with the local central-station company, but with the parsimonious policy of those who arranged the existing schedule of thoroughfare illumination. Last year's Board of Selectmen, in an endeavor to furnish street lights in the morning during the winter months, without increasing the lighting expense to the town, signed a contract whereby the town was to be without lights five nights each month, to cover the cost of the early morning service. The contract called for lights during the winter months for an hour before daylight, and specified that the street-lighting expense should not be increased; that on the night of the full of the moon and on the two nights before and after this event, the lights should be turned off.

The results have been anything but satisfactory. An effort was made at the last annual meeting to appropriate the necessary amount for lighting the streets every night, but the plan failed because the moonlight schedule worked fairly well during the winter, when the trees were without foliage, and because a spirit of economy ruled the meeting. Apart from the fact that the trees were denuded during the winter and early spring, it so happened that there was pleasant weather each month at the full of the moon. Last month storm clouds hid the moon on each of the five "open-circuit" nights, and even those familiar with the streets found it next to impossible to grope their way about after dark. During June, with its accompanying heavy foliage, the moon has been of little value and on many nights the streets have been as dark as on stormy nights earlier in the season. Business men have had a double reason for complaint, as they are compelled to be out in the darkness and be denied much of their night trade. One of the recent no-light evenings fell upon a Saturday, when the local merchants look for about one-third of their week's business. The company offered the voters at the town meeting to turn on the lights any stormy night during the full moon, cutting them off on another night to offset the cost. This left the town in darkness when there was no moon to pay for the stormy night.

As a practical example of the drawbacks of a policy of rigid economy in street lighting, this situation is worth considering by all municipalities tempted to save a small sum on a total yearly lighting bill by counting upon the moon as a cost-free and efficient illuminant. Care in spending the public funds is an excellent thing in the right place, but no fair-minded citizen who believes in progress can fail to admit that pitch-black streets are a mistaken policy when considered in relation, not only to the stimulation of local trade, but to the prevention of accidents on the highways. There may be places where the moonlight schedule has its usefulness, notably in towns having few trees and a very high percentage of fair nights, but the experience of Monson and many other places whose service could be paralleled with it indicates that an every-night service is much to be preferred, even at a slight increase in cost.

THE STORAGE BATTERY FOR SUBSTATIONS.

Stand-by storage batteries are a commonplace feature of large central-station practice in cities where a considerable area of direct-current service is maintained, and in exciter operation nothing has come to be a greater reliance than the set of floating cells which safeguards the bus from voltage collapse in case of even momentary trouble with these small but important generating sets. A larger field for the storage battery, however, is in sight in connection with combined electric railway, power and lighting distribution from substations in the so-called alternating-current districts of large central stations. Separated from the generating plants by long lines, often with mixed overhead and underground sections, many of these substations are coming into such prominence as load centers that every possible precaution is demanded for the maintenance of continuous and even service.

Investigations indicate that much success is assured along the lines of safeguarding continuous service, not only in the direction of the local customers' requirements, but in connection with temporary troubles elsewhere on transmission systems, the battery feeding back to other stations or substations through a booster installation and via the transformers. In the study of installations of this kind great skill is desirable in the analysis of existing and the anticipation of future load curves, and the determination of the maximum investment is a problem of no mean dimensions. Some sort of compromise must evidently be made as to the size of substation stand-by battery which can be installed without undue outlay, and in many cases it will doubtless be necessary to make preparations for subdividing the emergency service of such installations between the more important classes of load, according to conditions prevailing at the time of the line interruption.

It may seem to some engineers as though the reliability of moderate-voltage transmission is now high enough to warrant the exclusion of substation stand-by facilities of the kind in prospect, but as the value of the load increases, and particularly as the standards of the public rise, companies whose service is constantly advertised as superior to that offered by the isolated plant will have to face the investment which such stand-by facilities impose. It may be sufficient to carry the local load for 15 or 30 minutes in case of interrupted transmission, but in many communities this filling of the gap in case of outside trouble will be worth all that it costs.

Association of Edison Illuminating Companies to Meet in West Virginia.

The annual convention of the Association of Edison Illuminating Companies will be held on September 14 to 17 at the Greenbrier Hotel, White Sulphur Springs, W. Va. The usual reception will open the convention on Monday evening, September 14. Convention sessions are scheduled for the three following days; these will be held in the large ballroom of the White Hotel adjoining and connecting with the Greenbrier, leaving the latter entirely free for the entertainment and social features of the convention. An unusually large attendance of ladies is expected, and arrangements will be liberally provided for their comfort and entertainment.

It is planned to confine the active work of the convention to about 12 general papers and 10 special committee reports. With a few exceptions presentation of these papers and reports will be confined to 20 minutes each, so as to leave as much time as possible for discussion. It is expected that a few exhibits showing the latest developments in incandescent lamps and possibly a few other electrical developments will be shown.

Excellent facilities are available for golf, tennis, swimming, riding and driving. As usual, a large number of prizes will be awarded. Arthur Williams, New York Edison Company, is president of the association and has sent preliminary notice of the convention.

Program for Ohio Electric Light Convention.

As previously announced in these columns, the annual convention of the Ohio Electrical Light Association will be held in the large assembly room of the hotel.

At the first session Tuesday afternoon there will be presented the address of President J. C. Martin, also reports of the secretary and a number of the standing committees, including the Executive, Advisory and Insurance committees. A special report will be presented by the Committee on Illumination, of which S. E. Doane, Cleveland, O., is chairman.

On Wednesday morning there will be presented reports by the Meter Committee, A. H. Bryant, Cleveland, O., chairman; Committee on Electric Transmissions, M. H. Wagner, Dayton, O., chairman; Committee on Uniform Accounting, L. H. Funkhouser, Dayton, O., chairman; Nominating Committee.

On Wednesday afternoon there will be given an illustrated lecture by Dr. Thomas Darlington, secretary of the Welfare Committee of the Iron and Steel Institute; the subject will be "Welfare Work in Industry."

The Thursday morning session will open with a paper entitled "Power Service," by J. H. Mitchell, of the Columbus Railway, Power & Light Company. Reports will be submitted by the Committee on New Business Co-operations, Thomas F. Kelly, Dayton, O., chairman, and the Committee on Electric Vehicles, M. F. Turner, Cleveland, O., chairman.

On Thursday afternoon there will be an illustrated lecture by M. Luckiesh, Cleveland, O., on the subject "Light, Shade and Color in Illumination."

The final session will be held Friday morning. A report will be presented to the Appraisal Committee. Halford Erickson, chairman of the Wisconsin Railroad Commission, will deliver an address entitled "Indeterminate Franchises." An address on municipal ownership is also expected from some one representing municipal plants.

As usual, elaborate entertainment features have been planned in connection with the convention. Special entertainment will be provided for the ladies as follows: Musicale and card parties on Tuesday afternoon and Friday morning; launch ride on Sandusky Bay Wednesday afternoon. On Tuesday evening all attending the convention will be invited to an informal ball. On Wednesday evening will be given the annual Association banquet. Thursday evening there will be a musicale in the hotel lobby, followed by the Annual Association ball.

D. L. Gaskill, Greenville, O., is secretary of the Association.

Anthony N. Brady Medals to Promote Safety on Electric Railways.

The family of the late Anthony N. Brady has made arrangements with the American Museum of Safety, New York City, for the annual award of a gold medal to any American electric railway company which, during the year of award, shall have done the most to conserve the life and health of its passengers and employees. In addition to the gold medal to be awarded to the company, a replica in silver will be awarded to the member of the operating staff who has contributed most to the successful record of the company; another replica in bronze will be awarded to the employee of the company whose services have been of the greatest value to the promotion of safety and health. A committee, of which Arthur W. Brady is chairman and Charles S. Sergeant and Frank Hedley are the other members, has been appointed by the American Electric Railway Association to formulate the conditions of the competition. These have now been printed and are available to electric railway companies. Dr. William H. Tolman, director of the Museum, is secretary of the committee.

World's Insurance Congress at Panama-Pacific Exposition.

Arrangements are now being made for a World's Insurance Congress to be held from October 1 to October 15, 1915, in San Francisco, Cal., in connection with the Panama-Pacific International Exposition. It will be held under the auspices of a national council, created through representation from every national and international association whose membership derives livelihood from the business of insurance or its allied professions. Up to the present time over 50 of these associations have already indorsed the movement by resolution, and named their representatives to serve on the council. Electrical organizations interested in fire-prevention work are now being invited to participate in the congress.

In connection with insurance matters, the authorities of the Exposition have designated the week beginning April 18, 1915, as insurance week; this will commemorate the ninth anniversary of the destructive San Francisco earthquake and fire of 1906. It is believed that San Francisco, completely rebuilt by insurance money, will afford the most interesting exhibit in this line and emphasize the value and efficiency of insurance. W. L. Hathaway, Exposition building, San Francisco, is commissioner of insurance and has these matters under his direction. Garner Curran is deputy commissioner.

Special Fourth of July Illumination for New York City.

About 25,000 multi-colored electric lamps will illuminate the parks and monuments of Manhattan Island and the other boroughs of New York City on July 4. Each of the boroughs will have its quota of illumination in the plans drawn up by the Illumination Committee, of which Arthur Williams is chairman. $25,000 has been appropriated by the city for celebrating the "Fourth," of which $11,000 will be spent to wire the monuments and parks for lighting. The current for all of the illuminations in Manhattan will be donated, as in previous years, by the New York Edison Company, and in the other boroughs by the local electric light companies.

Raymond J. Andrus.

Of considerable variety and certainly of remarkable interest, the career of Raymond J. Andrus, vice-president and general manager of the Northwest Electric & Water Works, is worthy of distinct and elaborate comment.

Mr. Andrus was born at Rockford, Ill., in 1884. He received his early education in the country schools and completed this work in high school at Mason City, Iowa. He entered the College of Engineering and Mechanical Arts of the University of Minnesota, in the fall of 1902, graduating in 1907 with the degree of Electrical Engineer. Upon graduation he entered the employ of the Helena Power Transmission Company, now the Missouri River Power Company. After some time spent in establishing a thorough knowledge of attending to the polishing of the brass cooling pipes and dusting transformers he considered his education complete in this direction and decided to graduate from the employment of that company. As he says himself, he was short of railway fare to reach Seattle, so he stopped off at Spokane, where for some months he was employed with the Spokane Engineering Company. He soon became chief draftsman of that concern. It was not long, however, before he decided that the outlook over the edge of the drafting table was limited in scope, so he hied himself to the offices of the Washington Water Power Company, where he got on the blind side of M. C. Osborn, at that time and now commercial agent of the company. Mr. Osborn gave him a start in the bad account department, his principal duty being to "get the money" or remove the plugs without getting kicked out or otherwise maltreated. It is understood that his work in this department was so bad that Osborn decided he should be a success in securing new customers as his record in the elimination of bad ones was very unfortunate. He was, therefore, made assistant agent in a new residence territory, and made good so quickly that he was soon in charge of a downtown district as district agent. In the fall of 1909, Robert E. Strahorn, who promoted and completed the North Coast Railway, acquired a number of properties in the Yakima Valley, extending from North Yakima to Pasco. It was here that Osborn's great friendship was again demonstrated, and when Strahorn asked for a good man to take the managership of his plants Andrus was recommended and took responsible charge of the electric and water power plants in the lower valley. During the time of his association with Mr. Strahorn, the company constructed a transmission line 90 miles in length from Kennewick to North Yakima, and built up an irrigation load of several thousand horsepower in electric motors for irrigation pumping. Mr. Andrus was also in charge of the design and construction of a large auxiliary steam plant at Kennewick.

In 1911 these properties were acquired by the Pacific Power & Light Company, of Portland, Ore., a subsidiary corporation of the Electric Bond & Share Company of New York. Mr. Andrus remained with the purchasers in the capacity of manager of their interests at Pasco, Kennewick, Benton City, Richland, White Bluffs, Burbank, Finley and Attalia until March, 1912. At that time he joined forces, in the capacity of new business manager, with the Northwest Electric & Water Works, making his headquarters at Montesano, Wash. He assumed the title of vice-president and general manager on January 1, 1913, and at the present time is making further reputation in this capacity.

Raymond J. Andrus,
General manager of the Northwest Electric & Water Works.

Administration Water-Power Development Bill.

The bill providing for the development, control and leasing of water power on public lands, which has been drafted in accordance with the ideas of Secretary of the Interior Lane and which has met the approval of President Wilson, has been favorably reported to the House of Representatives in Congress, by the Committee of Public Lands. Special efforts are being made by friends of the administration to secure the passage of the bill and other conservation measures favored by the administration.

This water-power bill gives authority to the Secretary of the Interior to prepare regulations for leasing to individuals, associations or corporations public lands for the purpose of constructing dams, reservoirs, transmission lines and other things necessary for the generation and transmission of water power.

Leases are to run for 50 years, revocable only for breach of terms, and the property is then subject to revision to the Government, if desired, on payment of the actual cost of the water-power plant with permanent land improvements as necessary equipment.

The Secretary of the Interior has the power to give preference in granting leases to state, county or municipal systems.

To prevent monopoly, no lessee will be permitted to sell to any one consumer more than half the output of any plant, and the Secretary is to control all combinations of plants or lines to prevent restraint of trade or agreements to increase prices.

Control of charges for service and issuance of stocks and bonds will be under the supervision of the Secretary.

Sale or delivery of power to a distributing company is restricted to a 30-day term, and the written assent of the Secretary is necessary to an assignment of the lease.

Leases of power opportunities solely for municipal use, or not in excess of 25 horsepower to individuals or corporations for domestic, mining or irrigation purposes shall be without charge, but in all other leases the Secretary shall specify a rental, the proceeds to be paid into the reclamation fund. On receipt of the rental fund by the Reclamation Service one-half of the amount is to be given to the state.

Electrical Exports for April.

The Bureau of Foreign and Domestic Commerce has issued its monthly summary of imports and exports of the United States for April. From this report are taken the following data on the electrical exports during that month.

A considerable falling off is to be noted in the April total as compared with the immediately preceding months and with April of last year. For the four classes for which the numbers are reported there were shipped in April 3,040 fans, 38 arc lamps, 35,830 carbon-filament lamps, 104,714 metal-filament lamps.

The detailed figures are given in the following table, together with those of April, 1913:

Articles.	April, 1914.	April, 1913.
Batteries	$ 65,001	.....
Dynamos and generators	176,469	$187,098
Fans	38,525	28,517
Insulated wire and cables	86,993	.....
Interior wiring supplies, etc. (including fixtures)	60,891	.....
Lamps—		
Arc	1,063	25,059
Carbon-filament	4,621	23,799
Metal-filament	20,820	34,284
Motors	341,369	408,093
Static transformers	93,247	.....
Telegraph instruments, (including wireless apparatus)	8,654	16,484
Telephones	73,061	106,848
All other	770,837	1,720,949
Total	$1,741,551	$2,551,131

Warren Jovians to Hold Exposition.

Members of the Jovian Order in Warren, O., are making plans for elaborate electrical displays of various sorts for the electrical exposition which is to be held in that city under their auspices in September. The street lighting is to be a special feature, original designs calling for the use of a large number of lights being contemplated. Electricity will also play an important part in a night pageant which is to be one of the spectacular events of the exposition. The new National Guard Armory, now nearing completion, will be used for a display room, in which the exhibits of manufacturers and dealers who have indicated their intention of being represented will be shown.

Jovian Activities in Dayton.

W. W. Freeman, vice-president and general manager of the Union Gas & Electric Company, of Cincinnati, O., and past-president of the National Electric Light Association, was the guest of honor and the principal speaker at a meeting of the Jovians of Dayton, O., on the evening of June 22. The affair was the last of the monthly dinners, which have featured the spring and winter sessions of the organization, before the summer vacation. A large attendance, embracing practically the entire membership of the organization, as well as a number of guests, greeted Mr. Freeman. There were informal talks from a number of other electrical men of prominence. The banquet room was rendered cool and comfortable by the use of a large number of electric fans, of the small desk size, placed on the table, a unique idea especially appropriate for use at a gathering of representatives of the electrical industry. Committees were appointed for the purpose of arranging for two picnics to be held by the Jovians during the summer, one in July and one in August, which will take the place of the monthly dinners heretofore held.

Telephone Pioneers of America Will Meet at Richmond.

The fourth annual meeting of the Telephone Pioneers of America will be held at Richmond, Va., October 29 and 30, 1914. The headquarters will be at the Jefferson Hotel.

The officers of the Association are:

President, Theodore N. Vail.

Vice-presidents, Thomas D. Lockwood, Thomas B. Doolittle, Charles F. Sise, George E. McFarland.

Secretary, Henry W. Pope.

Treasurer, George D. Milne.

Excutive Committee, Angus S. Hibbard, chairman; Charles G. DuBois, Charles E. Scribner, Edgar F. Sherwood, James T. Moran.

Corresponding Secretaries, P. Kerr Higgins, St. Louis, Mo.; Darwin P. Fullerton, San Francisco, Cal.; William B. T. Belt, Omaha, Neb.; William J. Maiden, Chicago, Ill.; Kenneth J. Dunstan, Toronto, Ont.; Howard B. Emery, Boston, Mass.; William J. McLaughlin, Philadelphia, Pa.; Henry W. Bellard, Denver, Colo.; George W. Foster, Dallas, Tex.; Edward E. Bawsel, Nashville, Tenn.; William H. Adkins, Atlanta, Ga.; William T. Naff, New Orleans, La.

British National Wireless Research.

The committee appointed by the British postmaster-general to report upon the measures that the government should undertake in providing for wireless telegraph research, recommends the setting up of some body or institution to initiate and contro' research in matters of general principle, which cannot conveniently be investigated in departmental laboratories. The said body is also to coordinate the work now undertaken by the postoffice admiralty and war office, respectively, in wireless experiment and research, so as to prevent overlapping. A national research laboratory is proposed at a first cost of $37,000 and an annual operating cost of $24,000; it will be located at Teddington and will co-operate with the National Physical Laboratory. The laboratory would conduct research work bearing on the practical needs of the services principally in wireless telegraphy, but "it is undesirable to exclude the problems of ordinary telegraphy and telephony."

In the same connection it is proposed that the government shall appoint a national committee for telegraphic research to promote, both by theoretical investigation and by experiment, the progress of scientific telegraphy and telephony, and co-ordinate and supplement the work of the government departments named above. This national committee will be composed of the following representatives: One from Admiralty, one from War Office; two, Postoffice; two, Treasury; three nominated by the Royal Society; one nominated by the Institution of Electrical Engineers.

Tax Valuations of Ohio Electric Light Plants Increased.

Increase in the taxable value of all electric light plants in Ohio for 1914 amounts to $3,848,030. The total is $40,291,830, as compared with $36,443,800 in 1913. This announcement has just been made by the State Tax Commission. The list includes 13 new corporations which have been started during the past year.

One of the large increases was in the properties of the Columbus Railway & Light Company, now operated by the Columbus Railway, Power & Light Company, which was raised from $11,911,140 to $12,464,700, making a boost of $553,560. The Canton Electric Company is another concern which received a big advance, being listed for $2,116,170 this year as compared with $1,760,080 in 1913. The Ohio Light & Power Company is raised to $1,662,110 from $1,455,150; and the Cleveland Electric Illuminating Company to $17,792,560 from $16,513,560.

Coast-to-Coast Telephony Predicted for 1915.

John J. Carty, chief engineer of the American Telephone & Telegraph Company, in a recent statement said that such progress has been achieved in completing the telephonic connection between Denver, Colo., and San Francisco, Cal., as to make quite certain that good telephonic communication between New York City and the Golden Gate will be achieved as one of the features marking the opening of the Panama-Pacific International Exposition next February.

Banquet of Schenectady Section.

The annual banquet of the Schenectady section of the American Institute of Electrical Engineers will be held on the evening of June 30.

Michigan Section N. E. L. A.

Annual Convention-Cruise on Great Lakes, June 17 to 20

For the third time in the history of the Michigan State electrical organization, its annual convention was held aboard ship, the cruise this year being in the nature of an elaborate sight-seeing trip, taking in such points as Niagara Falls, the Thousand Islands of the St. Lawrence River, and Toronto, Ontario.

About 125 members and guests had registered on Wednesday evening, when the steamer *City of Cleveland III* sailed from Detroit for Buffalo, N. Y. Special interurban cars were provided at the latter destination, which conveyed the entire party to Niagara Falls. The day was spent here visiting the many wonderful sights and an opportunity was also had to inspect the plants of the Ontario Falls Power Company and the Niagara Falls Power Company, guides being delegated by the respective companies for this purpose.

At 4 o'clock a special train was boarded for Youngstown, N. Y., proceeding by way of the Royal Gorge route. At Youngstown the steamer Rochester was waiting for the party and set sail immediately upon arrival of the special train. The Thousand Islands were passed at 6 a. m. on Friday, and at 10 a. m. the city of Ogdensburg, N. Y., was reached. Time was allowed here for viewing the historic points in the vicinity, and a special excursion was also made to the State Hospital.

Sailing from Ogdensburg, the next point visited was Alexandria Bay, where a specially constructed steam yacht conveyed the party through the channels not accessible to the larger boats. Leaving Alexandria Bay at 5 p. m. Friday, the trip to Toronto was made without stop, arriving 8 a. m. on Saturday. Here a special train was boarded for Detroit, running over the Canadian Pacific Railway, arriving at 2:30 p. m.

During the entire trip pleasant weather was encountered, and the cruse will long be remembered as one of the most interesting and enjoyable meetings of Michigan electrical men. Herbert Silvester, secretary of the section, is deserving of great credit for the manner in which he arranged every detail, and the success of the trip is, in a large measure, due to his efforts.

The trip was not all given over to pleasure, four business sessions being held, three aboard ship and one on the train en route to Detroit, the latter being an executive session. The three principal sessions were held at night, and the large number of papers scheduled for presentation did not allow sufficient time for discussion.

The first session was held in the dining room of the steamer *City of Cleveland III*, being called to order by President H. C. Sterling, at about 8:45 p. m. In the opening address President Sterling called attention to the work which was done during the past year by the various committees, and of the meetings attended personally by the president. He spoke of the recent convention of the National Electric Light Association at Philadelphia and a need for change in the method of holding conventions, because of the increasing size of this organization. He suggested that a solution of the problem would be conventions of geographical sections, with selected delegates from these attending the convention.

Mr. Sterling suggested that the gas and electric interests co-operate in the matter of conventions, as it is to the best interests of all concerned to have harmonious relations between such companies. Mr. Sterling quoted from census figures, showing the status of the central-station business in Michigan, and emphasized the fact that it is the second state in the number of municipal plants. He thought that if central-station managers would practice frankness and fairness with their customers, there would be less agitation for municipal ownership. In this connection, he called attention to the report of the Public Policy Committee, presented at the recent national convention. In conclusion, Mr. Sterling recommended that a committee be appointed to keep in close touch with the proposed utility regulation legislation, and also that the number of vice-presidents of the Association be increased from one to three.

A paper entitled "Reserves for Depreciation" was then presented by H. A. Fee, of Adrian, Mich. This paper points out that there is always a more or less insistent demand on the part of the public that public utilities reduce their rates, and regardless of the reasonableness of such rates, laws have been passed and regulatory bodies created with the idea that such reduction would be had. It is probable in the majority of cases the rates would not have been lowered at all had the companies concerned with the reductions been prepared to demonstrate that the apparent excess element in their rates was only that part of the rate that the users of their service must pay if they were to make suitable provision against the depreciation which was constantly accumulating from the various parts of their physical property, but which would not have to be met until some time in the future. Usually the book-keeping system is at fault, and one of the most common defects is in the treatment of depreciation. The subject of accumulated depreciation, inadequacy, obsolescense, disaster, and franchise loss, were discussed in this connection, and two methods of figuring depreciation discussed, i. e., the straight-line and the sinking-fund methods. The paper holds that the simplest method is a combination of the two. Under it one-twelfth of the annual depreciation, as calculated on the straight-line method, is set each month, and the funds so accumulated are then handled so as to yield the greatest earnings possible with safety.

Following this, Halford Erickson, railroad commissioner of Wisconsin, presented a very interesting and pertinent paper entitled "Regulation of Public Utilities and Returns Allowed Thereunder." This paper is presented elsewhere in this issue.

James B. Oxtoby, of Detroit, next presented a paper entitled "Contract and Franchise Rates as Affected by the Public Service Commission Laws." This paper discussed the rights of the commission to revise rates established by contract previous to the existence of the commission, and also to revise rates fixed in franchises granted by municipalities previous to the establishment of such a commission. A number of decisions bearing upon these two questions were recited, from which the following conclusions are drawn: All contracts entered into between a public utility and its customers are subject to cancellation or revision by a commission, exercising the police power of the state.

A public utility cannot by its conduct or course of dealing waive its obligations to properly perform its duties, or bind itself to continue in force rates or practices which are unreasonable or discriminative.

Rates named in contracts entered into prior to the enactment of the act authorizing the Michigan Railroad Commission to fix electric rates are cancelled upon the filing by the utility of its rate schedules as required by the orders of the Michigan Railroad Commission, when such schedules fix a new and different rate for the service.

Rates fixed by contract between a public utility and its customers are binding only so long as they are in accordance with the utility's published schedule of rates. When a rate is filed and published as required by law it becomes the legal rate to be charged thereafter, notwithstanding the existence of outstanding contracts, which contracts are thereby modified to that extent.

Rates fixed by a franchise are binding as between the municipality and the public utility. Whether or not such rates are subject to change directly or indirectly by legislative authority, where express power is conferred upon the municipality to agree upon rates, is open to question. The courts have not settled the question whether the legislature, under its "reserve power," has the right to alter, amend or repeal such franchises as it has expressly authorized. The courts have generally been content to hold that the power conferred upon the municipality to agree upon the rate was not absolute, and therefore the rate was subject to change.

Rates fixed by franchise may not be changed by the public utility alone, such as by its filing a new schedule of rates with the commission. A franchise rate, if subject to change at all, may be changed only by the legislature or by a public service commission, after a hearing.

Provisions in city charters recently adopted in Michigan, under the Home Rule act, undertaking to empower the city to regulate rates of electric utilities, are void, as in conflict with the provisions of the general law giving the railroad commission jurisdiction of the subject matter.

At this point a Nominating Committee, composed of R. W. Hemphill, Jr., Ann Arbor; J. L. Cavanaugh, Benton Harbor; and R. R. Thompson, of Battle Creek, was appointed.

An address by W. J. Norton, of Chicago, was then delivered on "Wild Schedules I Have Known." In his introductory remarks Mr. Norton commented on the mistakes made by utility companies by filing rate schedules with commissions, and urged uniformity in rate schedules, although there must necessarily be some difference in the actual rates.

This paper points out that rate-making for the sale of electricity is not a theory. It is an art. There are but three basic elements which should enter into the form of electric rates:

(1) quantity, (2) demand, and (3) customer expense.

The element of quantity is found in all rates, either in a simple form, as in the meter rate, or in an estimated quantity, as in the flat rate. The element of demand in electric rates is based upon the individual consumer's responsibility for the investment of the central station which stands ready to serve such customer. Demand may be measured by instrument, estimated as a percentage or connected load, by the use of statistics originally based upon measurement, or it may be based upon other functions of the customer's use or of the customer's premises.

Customer expense is a minor element in rate-making, and represents the cost to the company for such charges as meter reading, billing, postage, bookkeeping, etc., and bears no relation to either the quantity used or the demand of the customer upon the station.

The accepted forms of electric rates may be divided into two main classes: (1) meter rates; and (2) demand rates. There are four types of meter rates: straight-line meter rate; step meter rate; block meter rate; customers output rate.

The term "Meter Rate" is applicable to any method of charge of electric service which is based solely upon quantity. The quantity is expressed in units; as, kilowatt-hours of electricity used, tons of ice made, gallons of water pumped, etc. The term "Straight Line" as used in connection with a meter rate indicates that the price charged per unit is constant, i. e., does not vary on account of any increase or decrease in the number of units. The term "Step" as used in connection with a meter rate indicates that a certain specified price per unit is charged for all or any part of a specified number of units, with reductions in the price per unit based upon increases in the number of units, in accordance with a given schedule. The term "Block" used in connection with a meter rate indicates that a certain specified price per unit is charged for all or any part of a block of such units, and reduced prices per unit are charged for all or any part of succeeding blocks of the same or a different number of such units, each such reduced prices per unit apply only to a particular block or portion thereof. The term "Customer's Output Rate" is applicable to any method of charge for electric service based upon the customer's output of a certain definitely named commodity. The unit of customer's output may, for example, be a gallon of water pumped, a barrel of flour manufactured, or a ton of ice made.

The block meter rate is certainly the best of the meter rates, and in general it attempts to provide certain blocks which correspond in general averages to rates of the demand type. It certainly fails, however, to give the small but long-hour customer a rate as low as he is entitled to, and on the other hand, it gives to the large short-hour customer a discount to which he is not entitled. The general simplicity of the rate and the ease with which it is understood by the customers are the reasons for its adoption by many companies, especially for retail lighting, and on the whole it has given satisfactory results. The customer's output rate has been tried many times, but on the whole with very little success, and it generally results in a customer obtaining service at an unduly low rate, and as there is no inclination on the part of most customers to protect the company, the rate has a tendency to cause waste.

The term "Demand Rate" is applicable to any method of charge for electric service which included a charge which is based upon, or is a function of the use of maximum demand during the given period of time. The demand is expressed in such units as kilowatts, or horsepower. The term "Flat Demand Rate" is applicable to any method of charge for electric service which is based upon the customer's installation of energy consuming devices. Sometimes this type of rate is nominally so much per customer per year or per month for each of various classes of customers, but estimated demand, and quantity of energy likely to be used, play an important part in the determination of the class. Such a rate may be modified by the "Block or Step" method or features. The term "Wright Demand Rate" is applicable to that method of charge in which a maximum rate is charged for a certain amount of energy, and one or more lesser charges are made for the balance used on the block principle, in accordance with a schedule which is based upon the length of use of the maximum demand, as measured or estimated. The term "Hopkinson Demand Rate" is applicable to that method of charge for electric service which consists of a demand charge, a sum based upon the actual or estimated capacity of demand of the customer's installation, plus energy charge, a sum based upon the quantity of energy used. The term "Block Hopkinson Demand Rate" is applicable to any method of charge for electric service in which the charge made to the customer consists of a demand charge and a series of energy charges arranged on the block principle; or a series of demand charges and energy charges both of which are arranged on the block principle. Where either a series of demand or energy charges enters the rate, they may be arranged in two or more blocks. The term "Three

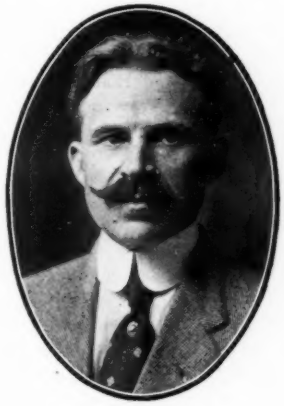
Charge Demand Rate" is applicable to that method of charging for electric service which consists of a customer charge, a charge per customer or per meter, plus a demand charge, a sum based upon the actual or estimated capacity or demand of the customer's installation; plus an energy charge, a sum based upon the quantitiy of energy used.

The demand rates may thus be divided into five general classes: (1) flat demand rate, (2) Wright demand rate, (3) Hopkinson demand rate, (4) block Hopkinson demand rate, (5) Doherty or three-charge rate.

Of the nine simple rate forms outlined seven are distinctly good and two, one the step meter rate and the other the customer's output rate, are bad. Any rate schedule should be based absolutely upon one of these seven good types and after the cost curve for any particular class of business has been properly determined, the company has its option of choosing one of the seven types. It is doubtful if the companies will ever have uniform rates, as rates are entirely a function of cost and cost must vary in different localities, but it ought not to be difficult to have all of our rates established on one of the standard forms, and when so established better results are obtained by adhering closely to the standard form rather than by attempting to complicate a rate.

The second session was held Thursday evening in the observation parlor of the Steamer *Rochester*. The first paper of the evening was by R. C. Hall, entitled "Deep Well Pumping." This paper discussed some of the general advantages of pumping by electricity, commenting on the direct-plunger lift and air-shaft methods. The installation of deep-well pumps now in service in the village of Richmond, and operated by the Eastern Michigan Edison Company, furnishing water to the water works system of that village, is described. The water supply is obtained from three deep wells, 131 feet deep, in which the water normally rises to within 65 feet of the surface of the ground. One well is equipped with an American Well Works motor-driven pump, operated by 25-horsepower motor, with automatic starting equipment. The second well is pumped with a Luitweiler non-pulsating, double-acting motor-driven pump head, operated by 15-horsepower motor, with automatic control equipment. The water is all pumped into a reservoir 100 feet high, and having a capacity of 87,000 gallons, so that under normal conditions the pumps have to work against a total static head of about 185 feet. Conditions in this plant are somewhat different than the ordinary water works, inasmuch as approximately 50 per cent of the total water pumped is re-sold in bulk to the railway company, and as railroads use much more water in the winter than in the summer, the winter consumption of the plant is about as large as the summer. The entire plant, including transformer substation for light and power service, is operated by one man, who is on duty in the day time only. Data on results of tests are presented and lantern slides showing the interior and exterior of the pump house were shown.

G. W. Bissel, following the presentation of this paper, called attention to the Hill-Trip deep-well pump, which has a motor on a vertical shaft, and an impeller at the water level, which raises the water to a centrifugal pump directly beneath the motor. Such a unit was found to have an efficiency of only about 25 per cent. H. A. Fee, of Adrian, reported unsatisfactory experiences with such a pumping unit, because of the frequent breaking of impeller blades. He also found the efficiency to be extremely low.



H. A. Fee,
President-Elect, Michigan Section, N. E. L. A.

Mr. Fee first began electrical business in 1886, at which time his father, J. H. Fee, purchased the Adrian (Mich.) lighting plant from W. A. Foote. On reaching his majority he was taken into the business under the firm name of J. H. Fee & Son. The business grew and in 1894 it was taken over by the Electric Light & Power Company, with H. A. Fee as manager. The business continued to prosper and in 1903 it became necessary to still further increase the investment and the present company was organized with J. H. Fee as president and H. A. Fee as manager, to take over the property of the Electric Light & Power Company. The new company built a new generating plant and greatly increased the business. In December, 1913, J. H. Fee died and H. A. Fee became president and general manager, which position he now holds.

A paper entitled "Hydroelectric Power in Michigan," was then presented by G. W. Bissel, of the Michigan Agricultural College. This paper presents the results of inquiries made during the past few months to ascertain the extent of water-power development at the present time. Replies to these inquiries are tabulated, showing the name and location of all hydroelectric plants in the state; the geographical distribution of the plants by county, city, or town, and drainage basin, the maximum horsepower of each, and in most cases the operating head. There are also maps of the upper and lower peninsulas of Michigan, showing the location of the various plants.

Following this a paper entitled "The Rowena Street Substation of the Edison Illuminating Company," was then presented by James W. Bishop, of Detroit. This paper describes the automatic rotary converter station of the Detroit Edison Company, which houses a 500-kilowatt, 60-cycle rotary converter, operating on an Edison three-wire direct-current system. It is started and stopped from another station a little more than a mile away. No other wires are used betwen stations, excepting the three-conductor 4,600-volt cable, supplying the three-phase current. There is no attendant at this station excepting for inspections, cleaning, etc. This station is located in a residential district, where there is no day load, and operates from lighting time until about 10 p. m. The paper was illustrated by numerous lantern slides, showing views of the equipment.

A paper entitled "Out-Door Substations" was presented by A. A. Meyer, of the Edison Illuminating Company, of Detroit. This paper first points out the possibilities that the wider development of out-door type substations will open up. Smaller towns, villages, farms, dairies, etc., bordering on transmission lines, have just as much need for electric service, but could not be supplied because of the lack of inexpensive transforming apparatus. Several distinct types of out-door substations, which differ, according to the voltage, nature and size of the load, were described and illustrated. Comment was made on the general requirements of such apparatus, and a brief description of the equipment necessary presented. Mr. Meyer concludes that while some of the more conservative engineers disapprove of the out-of-door station, on the basis of jeopardizing service, it is believed that such an argument will in time be proven groundless. The results which are being obtained by this type of station, and the large number which are being installed, seems to prove conclusively the practicability of the out-door substation. Slides were shown, demonstrating the wide application of the out-door substation, emphasizing the big field possible to develop by the employment of such equipment. Among the interesting applications were those for dredging with transformer installation on a float; irrigating, quarrying, and for farm work.

J. A. Cavanaugh, Benton Harbor, opened the discussion describing an installation of five miles of single-wire line, recently completed by his company. Such construction is not substituted for standard line construction, but is used only where it is possible to secure the business of small customers, which would be impossible to obtain unless line costs were extremely low. The load of the average power customer served from these single-wire lines does not exceed 0.5 horsepower.

R. R. Thompson, Battle Creek, stated that the Commonwealth Power Company is just starting the installation of out-door substations of the steel-construction type. He inquired of Mr. Cavanaugh as to whether the customer pays for cost of installation or not. Mr. Cavanaugh replied that the Company pays all costs, the customers along this line being farmers on small farms, ranging between 25 and 40 acres. Bills average from $2 to $25 per month. In reply to a question of Mr. Fee, as to rates charged for this service, Mr. Cavanaugh added that regular city rates were maintained, with a separate cooking rate of 5 cents per kilowatt-hour, with a 5 per cent discount. Cooking has become quite popular among the rural customers of the Benton Harbor Company.

The third session was held on Friday evening, in the dining room of the Steamer *Rochester*. The meeting was opened with an address by Charles B. Scott, of Chicago, on "Safety in the Electrical Industry." Mr. Scott said that not enough attention is given to preservation and conservation of human life, although the present agitation for "Safety First" is doing great good. In one case of an electric railway in a western state, from 12 to 15 per cent of the annual gross earnings were paid in settlement of damage suits for various injuries. After a systematic campaign to improve this situation, the amount paid out annually was reduced to a fraction of 1 per cent. Mr. Scott said that it has been proven in innumerable cases that accident prevention work is effective. He urged that employers should get the benefit of their employees' suggestions for the betterment of the work, as such suggestions have been found to be much more valuable than suggestions made by outsiders. Of 2,670 accident reports from electric utility companies investigated during a certain period by Mr. Scott, 1,085 were found to be common accidents, not due to an electrical hazard. This demonstrates that general prevention work, as carried out in other industries, can be effectively used by the central-station companies.

An illustrated paper entitled "Fundamental Principles of Interior Illumination" was then presented by M. Luckiesh, of the National Lamp Works. This paper discussed quality and distribution of light, as the two fundamental factors in any problem of illumination. In connection with the distribution, physiological conditions were discussed, as also the influence of surroundings and aesthetic conditions. Illustrations were presented, showing the effect of proper and improper distribution of light for illuminating paintings, statues, etc., and illustrating the effect of light on color values.

Following this a paper entitled "The New Mazda Lamp" was presented by J. R. Colville, of the National Lamp Works. This paper describes rather fully the new high-efficiency lamp, and the steps which led to its development. Processes of manufacture are described, and data given on its applications. President Sterling opened the discussion by inquiring if the new lamps could be burned in an upright position. Mr. Colville stated that the inert gas in the bulb reduces evaporation, which tends to reduce the blackening effect. With the lamps inverted, blackening takes place in the stem, which does not effect the efficiency of the lamp.

H. A. Fee, of Adrian, asked as to the difference in cost betwen the 6.6-ampere lamps, and 20-ampere lamps with compensator. Mr. Colville thought that there was enough saving in current to justify the use of the compensator with 20-ampere lamps.

Following this session, a rejuvenation of the Jovian Order was held, at which H. C. Sterling, statesman for Michigan, presided. Thirteen candidates were initiated into the Order.

An Executive Session was held in the dining car of the special train en route to Detroit, at which the following officers were elected for the ensuing year.

President, H. A. Fee, Adrian.

Vice-president, Samuel A. Freshney, Grand Rapids.

Secretary and Treasurer, Herbert Silvester, Detroit.

The new Executive Committe is composed of A. C. Marshall, Detroit; H. C. Sterling, Three Rivers; R. R. Thompson, Battle Creek; A. D. Furlong, Saginaw, and Thomas Chandler, Sault Ste. Marie.

Electrics in India.

Although it has been a common belief in India that, on account of very cheap labor, the bullock-cart mode of transport is the cheapest possible under the circumstances, yet lately experiments with motor trucks have shown that motor transport is really a much cheaper means of meeting the necessities of trade.

Lighting Rates Reduced to Large Customers in Cleveland.

Officials in charge of the operation of Cleveland's municipal electric plants are somewhat worried over a change in rates recently announced by the Cleveland Illuminating Company, which enable large users of current to secure power at much lower rates than the city can afford to quote, it is understood. The new plant at East Fifty-third Street, which is to be opened shortly, will be considerably affected by the change in rates, it is feared, as the probability is that many large consumers will contract with the Illuminating company, thus depriving the new municipal plant of a market for its current. So far, however, the City Council has taken no action on the matter, altough several members have expressed an opinion that the company should have lowered the rates for small rather than large consumers.

Sandusky Lighting-Rates Investigation.

H. Whitford Jones, an electrical engineer of Cleveland, O., has been employed by the city Council of Sandusky, O., to assist in arriving at an equitable basis for the adjustment of the commercial and street electric lighting rates in that city. His fee for the work will be $25 a day and all expenses. Mr. Jones recently installed a municipal electric plant for the city of Barbertown, O. He intends, if the Council desires it, to present plans for the installation of a "White Way" lighting system for the business district of Sandusky, and has already suggested tentative plans for that purpose.

Clever Window Display by Central-Station Company.

The Selina, Kans., Light, Heat & Power Company, which has attracted much favorable comment through its clever window displays, varied its offering recently by placing a lion and a kitten in its windows together. The two animals got along nicely, allaying the fears of those who watched with concern least the king of animals devour his tiny playmate. Investigation by passersby revealed the fact that the lion was stuffed, explaining its kindness.

There is perhaps no better example of the remarkable progress being made by Canada in providing transportation facilities throughout the length and breadth of the Dominion than the construction of an automobile highway from ocean to ocean, which is nearing completion.

Commercial Practice
Management, Rates, New Business

ORIGINAL COST AS A FACTOR IN REGULATION OF GAS AND ELECTRIC UTILITIES.[1]

By A. P. Watson,[2]

One of the gratifying facts in connection with the regulation of public utilities in general, and gas and electric utilities in particular, in Oklahoma, is that the men in charge of the active management of these utilities are constantly on the alert for improved methods and higher efficiency.

More and more is this true throughout the utility world, but especially, I feel, is this true of the gas and electric service world. Considering the fact that your organization includes also the managers of electric railways, I perhaps should make my observation sufficiently broad to include the managers of those corporations. However, as I understand your request for a few remarks from me, the subject you wish to hear discussed is that dealing with Corporation Commission Order Number 774, which has to do with gas and electric utilities only. Therefore, I will not, for the sake of seeming agreeable, attempt to broaden my remarks beyond the proper scope of their application.

Regulation a Matter of Cause and Effect.

In dealing with Order No. 774, which is, as indicated by its title, an order "relating to the reporting of original cost and filing of profiles and plats of gas and electric utilities, with classification of property accounts," we are dealing with an effect for which there was a cause. Regulation of utilities of any kind, anywhere, for that matter, is nothing more nor less than the operation of the law of cause and effect. Had there been no infringement by utilities upon the rightful interests of the public, regulation would not have been resorted to as a corrective of such infringement, and if the public were at all times reasonable in its expectation of what service it should receive and the terms upon which it should receive it, regulation would be less one-sided in its application than, as I fear some of you gentlemen sometimes feel, it now is.

Order No. 774, then, is an effect. In seeking its cause we must go back to the time when the relations between gas and electric utilities and the public first became a subject for the attention of the Corporation Commission. The constitution had been written with a view to putting all public utilities of whatsoever name or character under the jurisdiction of the Commission, in order that differences arising between the public and utilities of all kinds should be settled in the modern and orderly manner of recourse to the offices of the Commission instead of in the high-handed manner in vogue before commissions became general.

Settlement on Merit Sought.

The theory of the Commission adjustment of such differences was that investigation and deliberation as to the merits of the contentions of both sides should be the basis for action. Previously it had been the practice that adjustment of such differences had to be made on any basis that the utility management saw fit to impose if the complaining patron were just an ordinary citizen, or on any basis that the patron saw fit to impose if he happened to be a mayor or a member of a board of aldermen, an assessor or a county commissioner, or a person related to such a dignitary by even a remote degree of consanguinity or association. So, theoretically at least, the constitution provided a desirable and useful thing when it provided an orderly and uniform system for the adjudication of differences between utilities and their patrons, whether it be a difference arising over the matter of rates, or of franchises, or of service. It was much better for the utility, for instance, when application for an extension of mains was received, to have the matter decided upon a basis taking into consideration the number of patrons to be served, the cost of the extension and the probable return upon the investment, than to have it decided upon the arbitrary consideration that it was intended to serve the son-in-law of the assessor, and would involve an expenditure making it incumbent upon the company to deprive a more deserving locality of an extension in order that the applicant might be accommodated.

Shawnee Rate Case Raised Question.

It happened, in our case, that the first big complaint upon which the Commission could not bring the contending parties into agreement as to a fair basis for settlement was a complaint on the subject of gas rates at Shawnee. Consumers believed and contended that the rates in effect were too high, and the corporation believed and contended that they did not yield more than a reasonable return upon the investment, and should not be reduced.

The constitution having provided that when differences between utility managers and their patrons could not be adjusted by agreement of the parties they should be adjusted by the Corporation Commission, the Commission assumed jurisdiction in the Shawnee gas-rate controversy and took evidence upon the merits of the case. After due deliberation it was decided that there was a sufficient element of substantiality in the complaint and an order seeming to the Commission to afford a just solution of the trouble was agreed upon by the Commission and entered in accordance with the procedure it held to have been prescribed.

The corporation, however, was not satisfied with the order, and opposed it in the courts. The result of its opposition was that the court said the writers of the constitution and laws had not said what the Commission held they had said, and that because two or three words that were intended to have been written in the provisions describing and prescribing the jurisdiction of the Commission had been omitted, the Commission was without jurisdiction to enter the order it had entered in the Shawnee case. The relief assumed to have been afforded was held to have been beyond the power of the Commission to grant and was declared null and void.

This was a revelation that could have but one result, and that one result was recorded in due course of time. The state legislature said: "If the constitution and laws have failed to afford the measure of jurisdiction intended, the deficiency needs to be corrected," and Chapter 93 of the Laws of 1913, "an act extending jurisdiction of the Corporation Commission over gas and electric utilities," was passed, approved by the governor and established as the law of the state.

1 Paper presented before convention of the Gas, Electric and Street Railway Association of Oklahoma.

2 Corporation Commissioner.

It is not necessary to quote this law at this time, either in whole or in part, but it is generally conceded that the scope of the law is sufficiently broad to cover all probable eventualities for the future. Whether this observation is correct or not, the adoption of this law imposed upon the Corporation Commission the duty of its administration, and the first step toward compliance with such duty was necessarily the establishing of a uniform system of reports to be used as a basis for determining important factors in the valuation of the properties thus brought within the definite scope of the Commission's jurisdiction.

One of the greatest obstacles in the way of proper regulation of rates for utilities of all kinds, is the difficulty of arriving at the actual valuation of the property used.

A controversy over the sufficiency or excessiveness of a rate for public services presents no question for solution that is not offered by any business that is conducted for profit. The sufficiency or excessiveness of the charge for service can be demonstrated only by taking into consideration the amount of the charge, the expense of furnishing the service and the investment involved.

Uniform System Essential.

If like conclusions are to be reached in the case of like services, furnished at like expense and involving the use of a like investment, it is necessary that they be reached by the application of like formulae. If equally fair conclusions are to be reached where service is not identical, where expense is not the same and investment involves such dissimilarities that there is little or no basis for comparison of one property with another, it is essential that such conclusions be arrived at by following a uniform classification of property and accounts.

There is no advantage in going into detail in explanation of the meaning of this order at this time. The result would be, probably, that the details discussed would impress a few as important while for the great majority they would involve no difficulty whatever, while some other detail, not touched upon, would be one that has been causing consternation in the mind of some manager who finds it particularly difficult to adapt the requirements of the order to his particular property.

Protection for All Concerned.

The purpose in the mind of the Commission in the promulgation of this order was not alone the establishing of a basis for reduction of rates where rates are too high but equally the protection of the utility against unjust demands for reduction in rates. The Commission does not exist as a guarantee of a profitable return on operation of utilities. Such concerns, like any private business, may be established in communities which are not ready for them and are incapable of supporting them. They may be burdened with extravagant or incompetent management. They may be overdeveloped in the matter of readiness to serve, or for any other of a multiplicity of reasons it may be impossible for them to make a sufficient return on operation to satisfy the expectations of their promotions, and losses may result. Such cases must stand or fall on their merit, and it is the purpose of Order No. 774 to determine what is the merit in each case.

It would be impossible for us to devote our attention to a more important subject than is involved in this order. There is scarcely a community anywhere, receiving gas or electric service, that does not contain a certain percentage of population that believes rates for such service are too high. There is nothing to prevent such persons from appealing to the Corporation Commission for a reduction in charges, and when such applications are received it is incumbent upon the Commission to dispose of them. While the Commission may see nothing in the survey of the situation possible to be made by its engineering department or by its accountants that indicates an unreasonable charge, the Commission cannot arbitrarily rule that there is no merit in the complaint and dismiss the same. There must be a basis for getting at the facts and developing a conclusion doing justice to all parties concerned, and it is a candid expression of my belief that compliance with the requirements of Order No. 774 will protect the utility against unjust complaint over its charges more often than it will result in a reduction of the rate.

The present is not the first instance wherein the Commission has imposed requirements that have at first caused uneasiness on the part of the utilities involved, especially the smaller ones.

While a large part of the fear that Order 774 would prove burdensome that has been heard by the Commission has been expressed by the smaller concerns, it is the large ones on which the requirements of the orders entail the most work. On all alike, however, falls the benefit of the established system of handling these heretofore troublesome questions, when once the system is thoroughly established. It is the wish and the purpose of the Corporation Commission to assist in the operation of all utilities by removing causes of friction and of injustice and substituting therefor a harmonious relationship between the utility and the public and an adjustment of differences on a basis of fairness and justice.

Utah Light & Railway Company Section, N. E. L. A.

The employees of the Utah Light & Railway Company held their first summer outing at the beautiful Pinecrest Inn at the head of Emigration Canyon which is reached by the electric line of the Emigration Canyon Railroad Company.

The 150 employees with their ladies left Salt Lake City on the 2:30-p. m. train and spent the balance of the afternoon tramping over the hills and resting in the countless shady nooks which make this mountain resort so pleasureable. At 6:30 p. m. the company sat down to the celebrated trout and chicken dinner served by the Pinecrest Inn. At the conclusion of the dinner short toasts were responded to by G. B. Walker, Wm. Scott, and A. W. Milgate. F. A. Keyworth acted as toastmaster. Lloyd Garrison read the Company Section "Gimlet" which contained numerous jibes on the various company employees. H. C. Dunbar, the popular comedian from the line and service deparment, provided his usual fund of amusement. At the conclusion of the dinner the following officers were elected for the ensuing year:

President, A. E. Kennelly, lines and service department; vice-president, W. E. Turner, engineering department; secretary and treasurer, E. C. Cathcart, storekeeper.

The party then adjourned to the hotel ballroom where dancing followed until the return of the special train.

Electric Cooking in New Railroad Depot.

One of the most interesting features of the new depot which the Oregon Short Line is constructing at Pocatello, Idaho, at an expense of $350,000, will be its kitchen equipment, which will be electrical throughout. All the mixing, baking, and cooking in this model kitchen will be done by electricity. The only coal used about the building will be for general heating purposes. The decision to go over to electric cooking was made by the Oregon Short Line engineers after a careful investigation of practically all of the large hotel equipments using electricity in Idaho and Utah.

It is quite likely that, if the installation proves to be as successful as the company's engineers anticipate, the use of electricity will be extended to the railroad's hotel service at many other points in the system. The electric power at this installation is purchased from the Great Shoshone & Twin Falls Water Power Company under a blanket contract between this company and the Oregon Short Line covering its entire system in Idaho reached by the distribution system of the Twin Falls Company.

Electric Sign Data

Electrical Advertising.

Norman B. Hickox of the Greenwood Advertising Company, Knoxville, Tenn., makes the following pertinent suggestions regarding electrical advertising in an electric sign journal.

In the first place to be successful you must keep everlastingly at it.

Advertising must be active, the kind that doesn't have to be sought out—positive not negative.

It must be carefully written, straightforward, truthful and purchased with discretion.

What do you buy when you buy advertising? You buy impressions on the public mind of your name, your goods, or your trademark, which incorporates, ofttimes, both. Electrical advertising is the cheapest medium through which you may purchase these impressions. Considered in any field or district, it compares so favorably with the circulation of the various advertising mediums of other natures, that its use has become universal. It has doubled the efficiency of outdoor publicity in effectiveness, scope and circulation—it has added a night shift to an already highly organized and developed selling force, and in its present form it can be readily made to converse familiarly with the public.

Like all other forms of advertising, the demand is constantly for novelty, varied effect, distinctiveness, and above all, individuality. With the coming of electricity into general advertising use, comes the need of the made-to-order display, for which it would be impossible to supply the demand, were it not for the designing departments now maintained by progressive manufacturers. These departments are made up of highly paid artists and engineers, who must work together in the creation of new ideas, so as to produce designs consistent with modern methods of construction. Satisfying displays cannot be turned out by a mere crew of metal-workers and electricians; the individual artistic touch must be there—the idea and the engineering layout must first be constructed—every detail worked out carefully—oftimes expensive experiments made—and the standards of electrical construction always respected. Finish, too, is an important factor, as the cost of an average display makes it imperative that its use be continued a number of months, or even years in the case of large signs.

The stock signs serve admirably with only a few in the locality, but any community becomes quickly saturated with such styles, while the possibilities of working out trademarks, special lettering, decorative effects, etc., in the individual sign are unlimited. The individual electrical display produces a more lasting impression on the mind of the public, so far as the individual advertiser is concerned; it is forcefully fixed on the mind, and while other signs may be "observed," it gets an audience.

The liberal use of Electrical Advertising has been responsible for the advancement of many of our cities, their gain in prestige being given an impetus by the increasing business of their individual enterprises. While the user of electrical advertising is helping his own profits to climb, he is also aiding in the general advancement.

Strangers shun the unlighted town, while every well lighted business district will always be thronged with after-dark crowds.

Electrical displays fulfill the prime requisites of all advertising—they keep everlastingly at it—every day and every night—they are active—they flash and move and whirl in a medley of color and motion. The thoughtless gaze of those awaiting the evening car strays invariably to some electrical display which has been carefully prepared to subtly leave its impression on the public mind.

So in selecting electrical advertising great care should be given even to the smallest detail.

Inexpensive slogan sign installed by the Federal Sign System (Electric).

The words "Cannon City" are in standard 16-inch Federal letters, using 92 five-watt lamps. The entire sign is made of blue-enameled steel with white letters.

At each end of sign is a 60-watt lamp in reflector for lighting lettering.

Very economical and satisfactory installation.

Electrical Construction

ELECTRICAL INSTALLATION IN HOTEL GIBSON.—II.

Details of Wire Shafts, and Floor Wiring.

This is the second installment of an article describing the electrical installation of the Hotel Gibson, Cincinnati, O. A. S. Schulman, Chicago, Ill., had the contract for the entire electrical installation and Bert L. Baldwin & Company, Cincinnati, O., had charge of all the engineering features of the building.

Three wire shafts are employed to effect the distribution of energy for light and power in the main building. In addition to these wire shafts, light and power risers supply the annex, machinery in the sub-basement and basement of the main building, stores, stage pockets, etc. The complete riser diagram for the building is shown in Fig. 11, the upper part of the figure being devoted to the risers carried in the three shafts and the lower part of the figure being devoted to the power and light feeders for the hotel annex, stores, stage pockets, and basement and sub-basement power and lighting apparatus. From the lower right part of Fig. 11 it is seen that all the sub-basement power apparatus, including motors for service hoist, fans, ash lift, sewerage ejectors, house pumps, agitators, brine pumps, etc., are supplied direct from the switchboard. The third and fourth-floor laundry and the basement kitchen are supplied in a similar manner.

Of the three wire shafts, shaft *C* is devoted to power feeders supplying the elevator motors in the pent house and the attic fans, shaft *A* is devoted entirely to lighting feeders and shaft *B* is devoted to lighting and power feeders, the latter supplying elevator motors in the pent house and the attic-fan cabinets. All stairway lights are supplied from a shaft-*B* cabinet located on the fifth floor. For roof signs, etc., a separate set of three No. 0 wires carried in a one-half-inch conduit located in shaft *A*, is employed. The remaining feeders in shaft *A* are used to supply floor circuits, a set of three No. 00 cables being carried in a one-half-inch conduit and each set supplying from 60 to about 98 floor circuits.

Most of the feeders in shaft *B* are heavier than those in shaft *A*. A separate set of three No. 2 wires carried in a one-half-inch conduit is run in this shaft to supply some of the 50-ampere stage pockets. Two power feeders are run in this shaft, one set supplying the attic fans and the other leading to the elevator pent house. The remaining risers in this shaft supply 110-200-volt three-wire lighting energy to the various circuits on the floors of the building. In general one set of feeders is employed to supply three floors or from about 70 to 120 circuits. On the lower floors where the load is heavier, one set of feeders supply only one or two floors.

Fig. 10—Method of Anchoring Cables.

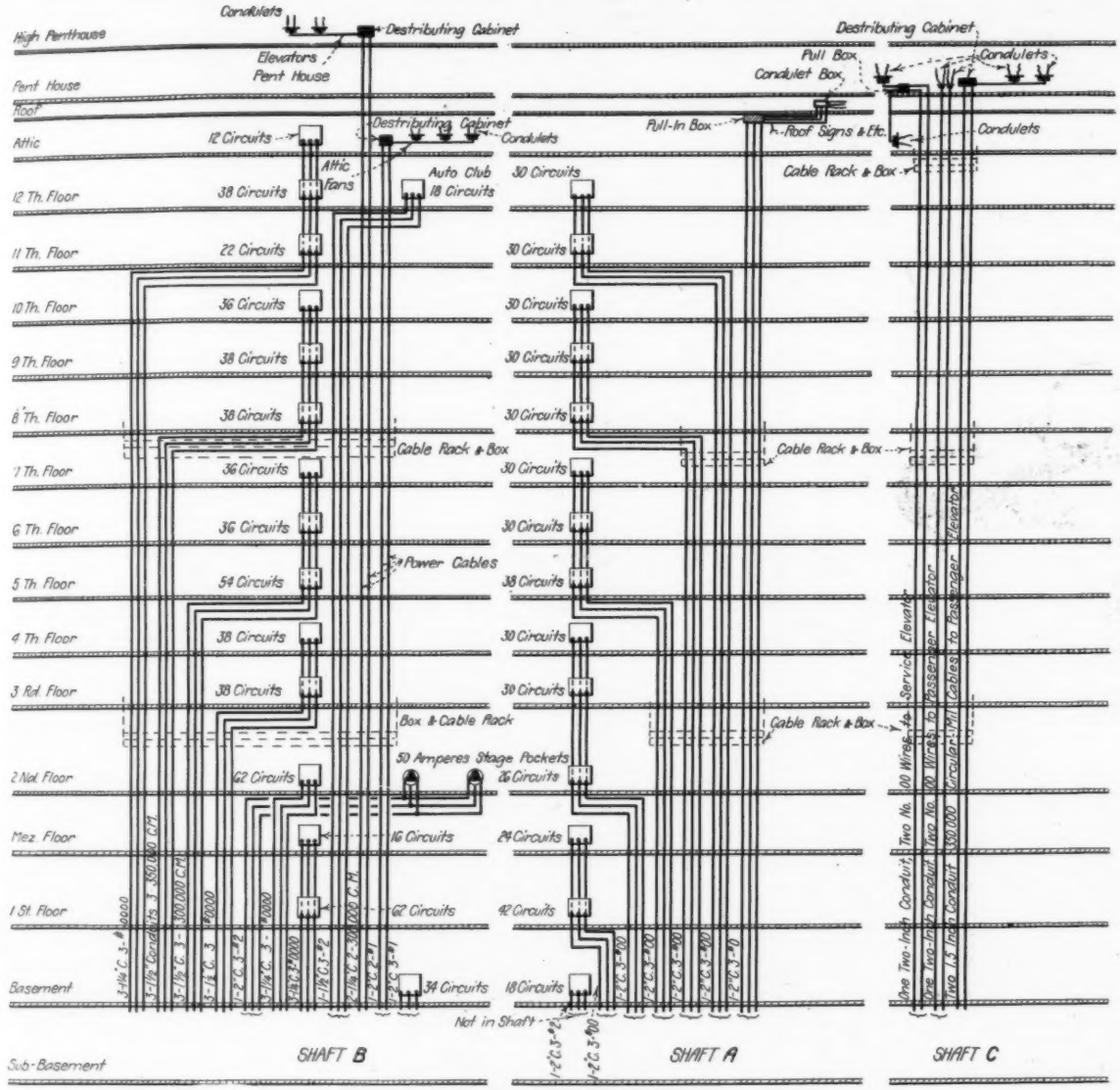
In laying out the plans for these wire shafts, a complete cable schedule was worked out so that the various reels of cable could be used in the most efficient manner, that is, with a minimum of waste. Each reel of cable was numbered, and the runs on which various reels were to be used were indicated.

In order to support the heavy cables in the various shafts, cable boxes and racks were inserted about 50 feet apart. These cable racks are made of No. 10-gauge steel plates supported by hangers of the same material bent to fit over and partly around a convenient wall or beam.

Fig. 12 shows one of these cable racks used in connection with the main feeders from the switchboard to the upper floors. The conduits are supported with 0.375-inch U bolts to the racks and the cables are supported by porcelain cleats to the steel cross bar of the rack. The upper portion of the pipe rack where the pipes and conduits are supported for the upper floors is not shown but the same type of construction as shown for the lower part of the rack is used. Near the floor are seen the conduits which are to lead to and from a cabinet panel controlling the branch circuits for the floor shown.

Fig. 14 shows this pipe rack and cable support after the wire shaft has been closed. The entire opening is not closed, a space being left open so as to permit access to the cable supports. An iron box with a hinged cover is placed at this opening. The conduits for the floor branch circuits and the floor feeders are shown ready for the placing of the panel-board box, the pipes being held in their proper positions by the wood beam as shown.

When long vertical runs of cable are employed, it is not only necessary to employ cable racks to relieve the cable from bearing its entire weight, but suitable cable anchors are necessary.



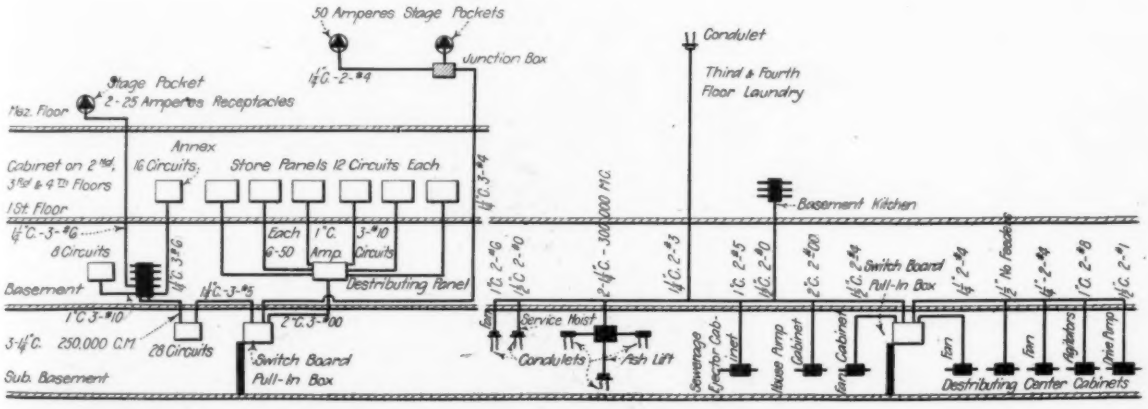


Fig. 11.—Riser Diagram.

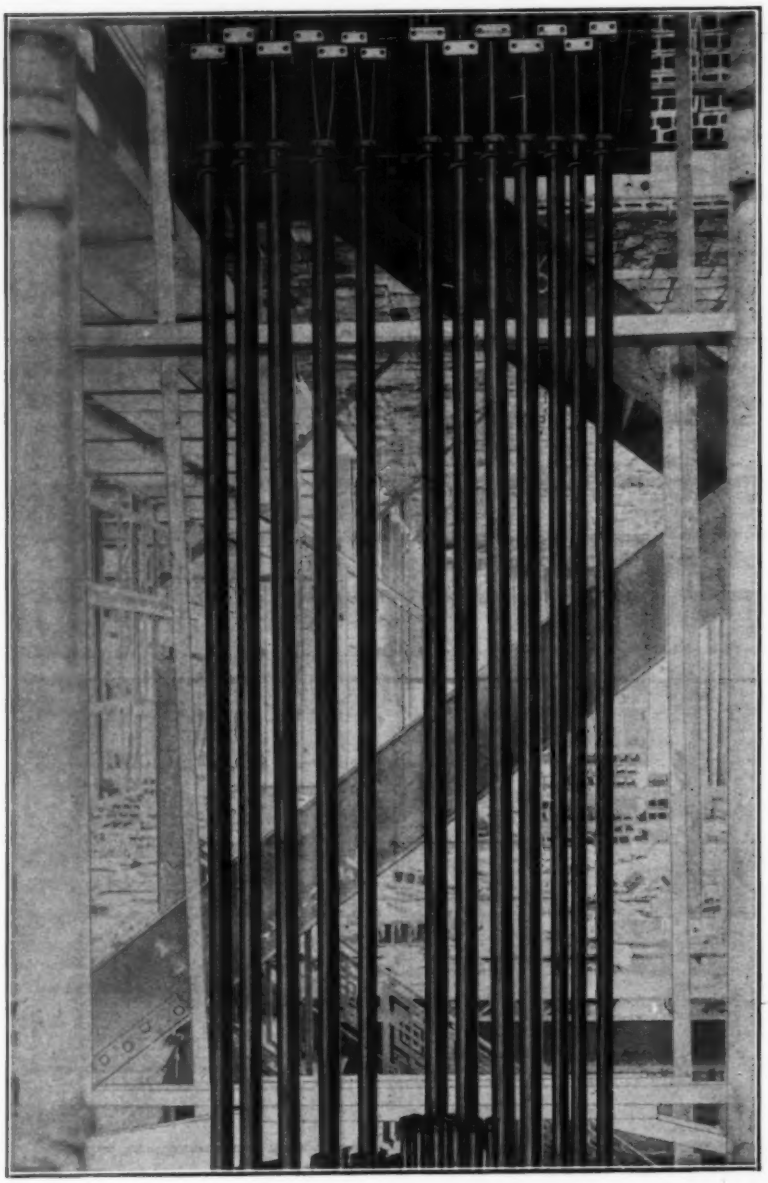


Fig. 12.—Cable and Conduit Rack.

Fig. 10 shows the conduits and cables as anchored at one of the distributing centers on an upper floor of the building. The heavy cables are supported at their ends by means of strain insulators and turn buckles hung from the steel frame of the building. All the supports for the ends of cables were made in a similar manner throughout the building, the concrete floors and steel framing of the building being utilized as a support in every case. The use of turn buckles as a part of the supporting member, has the advantage of permitting any slack in the cable due to expansion from temperature, strain or other causes, to be readily taken up. In order to permit access to these terminals at all times a sheet-steel box with a removable cover is placed in such a manner as to inclose the insulators and turn buckles but at the same time to permit of ready access to them.

This figure also shows the ends of the floor-circuit conduits, ready for the insertion of the floor-panel cabinet. During the process of construction work the ends of such conduits were always kept closed by boards or other means until the proper connections were made, thus preventing the entrance of concrete and other foreign material into the pipes.

Figs. 13 and 15 convey some idea of the great number of branch circuits required in the modern type of hotel. Fig. 13 shows the branch circuits brought into an angle-iron form. These forms were used whenever the panel-board cabinets were not available at the time of laying the conduits for the branch circuits. They consist of an angle-iron frame supported on jacks at the correct height from the floor. At the base of each rack a board is placed with holes at intervals corresponding to those that will be provided for the different conduits in the panel-board cabinet. These forms hence keep the conduits in their correct positions and construction work may proceed without any danger of displacing any runs of conduit.

In order to prevent cement and other foreign material from entering the ends of the conduits and thus either clog the pipes or render fishing difficult, a board is fastened over the conduit ends as shown in the figure.

Fig. 15 shows another one of these forms and a slightly different method of running the main and branch circuits leading from the panel-board form to the various outlets.

As can be seen from both of these figures, sharp bents were avoided as far as possible and no angle fittings employed in carrying the conduits to the panel-board cabinets, thus rendering the fishing of the cables a comparatively simple matter.

Floor Circuits.

In a hotel appearance is always of great importance, and not only is unslightly ex-

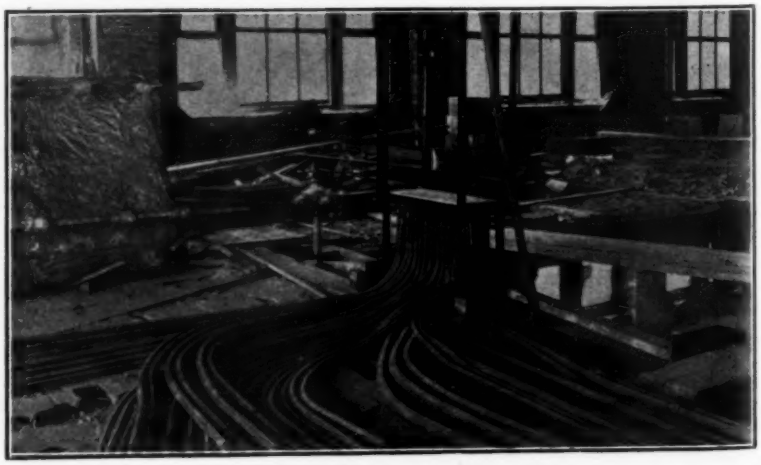


Fig. 13.—Angle-Iron Cabinet Form.

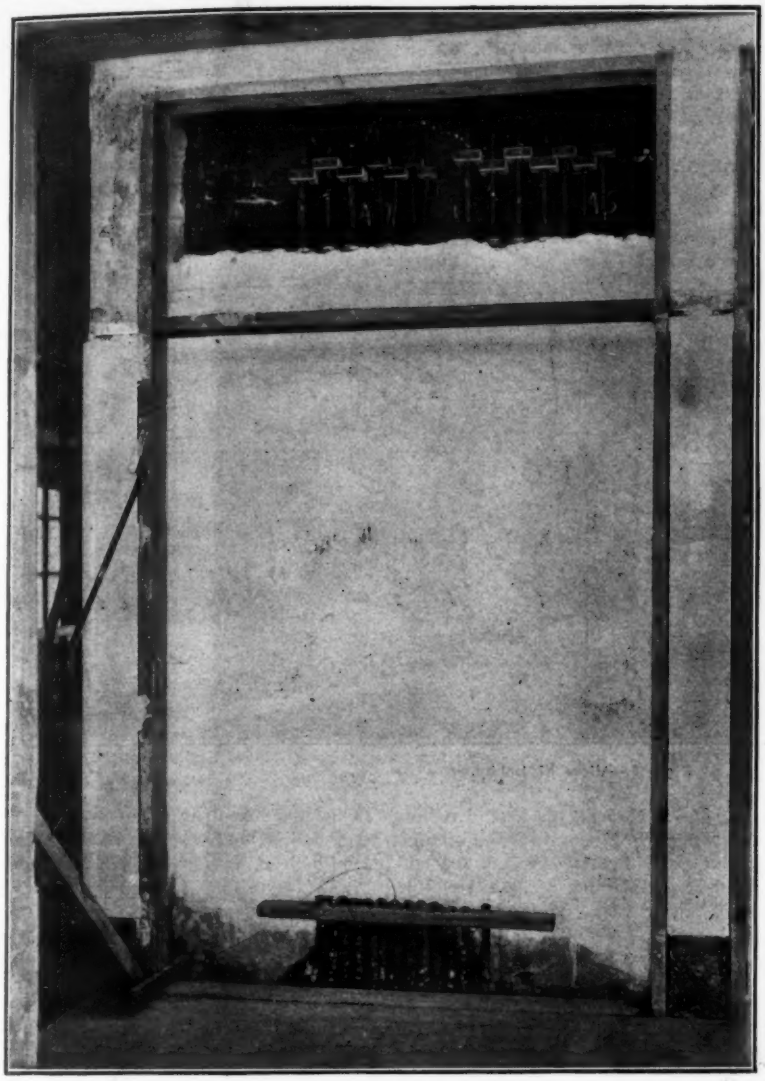


Fig. 14.—Cable and Pipe Rack Partly Inclosed.

posed wiring, cords, etc., prohibitive, but the various panel-board cabinets and distributing cabinets on the various floors in the guest portion of the hotel must be rendered as unobtrusive in appearance as possible. As far as possible, the wire shafts in this hotel were located in business sections, but where a shaft cabinet is located in a public section of the building, it is inclosed in a wall opening which is closed by a wood door matching in size and color the woodwork in the section. These wall openings also serve to conceal telephone cabinets.

All lighting cabinets are of sheet steel and slate and are equipped with N. E. C. standard inclosed fuses in each of the three supply mains, a three-pole main switch, and the same type of fuses with snap switches for the branch circuits. Between the slate panel board and the steel plate forming the back of the steel case, a horizontal steel bar is mounted to which are fastened porcelain cleats for fastening the various feeders entering the cabinet. The power cabinets and store lighting cabinets are smaller and less elaborate.

The wiring diagram for a section of a typical floor is shown in Fig. 19. From this diagram it is seen that each guest room has a ceiling outlet, and a bracket outlet for the dresser lights and a wall-receptacle outlet for use with a portable lamp. Each bath room contains a ceiling outlet and a bracket outlet. The ceiling lights in each room are controlled by a push-button switch near the door, and the ceiling lamp in each bath room is controlled by a similar switch situated near the bath-room door. In general all ceiling outlets for several rooms are attached to one circuit, the bracket and receptacles being attached to another. In this way the wiring of the rooms is greatly simplified.

The corridor lamps are supplied from two sets of feeders, each set of feeders supplying the corridor lamps in one section of the floor. The number of wires employed for feeding the corridor lamps in various sections of the floors varies as shown in the diagram. A four-wire system of distribution is in general employed, but in some sections, only a two-wire circuit is employed as shown.. In other sections a duplicate set of either two or four-wire feeders are employed in order to give control of the lamps from the main switchboard, thereby permitting certain lamps to be turned off during the early hours of the morning without the use of a number of individual switches. The connections for the various lamps and the corresponding feeder circuits can be traced on the diagram, the various circuits being lettered. In all cases the four or two wires constituting the distribution feeders for the corridor lights in any one section of the building are run in a single conduit, 0.75-inch conduit being employed for four feeders and 0.5-

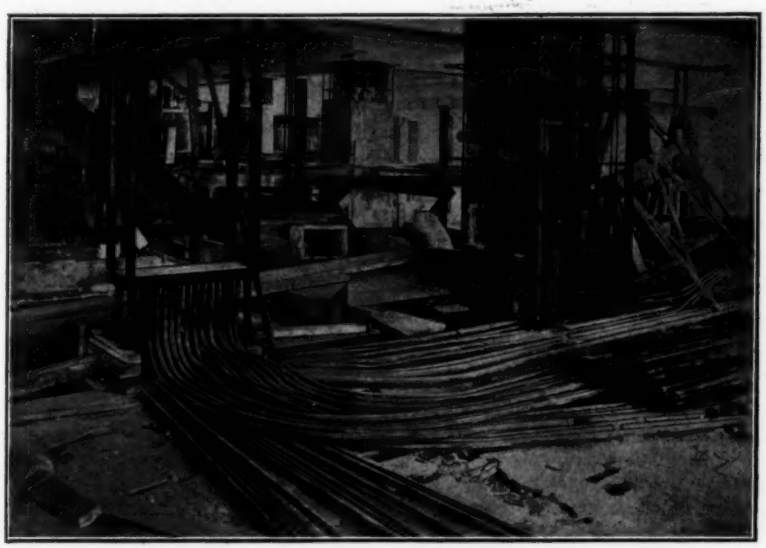


Fig. 15.—Angle-Iron Cabinet Form.

inch conduit being employed for two feeders.

The sample rooms are adequately lighted by means of numerous ceiling fixtures on one circuit extending around the ceiling several feet from the wall and controlled by one switch, by center ceiling fixtures on a separate circuit, and by bracket fixtures on still another circuit.

All stairway lights and red emergency lights are fed up and down from the fifth floor from an independent set of feeders.

The laundry, which is on the third floor of the annex, is wired with exposed conduit, all outlets being three feet above the floor level. The laundry machinery including washing machines, tumblers, etc., was made by the American Laundry Machinery Company. Most of the machines are worm-geared to the motors, and push-button starters are used. These push-button starters and the motors are connected to a panel board on which are mounted the automatic starter for the motors. The washing machines are of the automatic reversing type, drum controllers on the panel board effecting the reversal of motion.

Fig. 18 shows a view of the fountain or grill room. The fountain is supplied by a motor driven pump in the sub-basement, provision being made for cooling the water when desired. Fifteen semi-indirect Cassidy lighting fixtures are employed in this room. These are controlled from six push-button flush switches.

Fig. 17 shows a view of the main dining room. Eight semi-indirect Cassidy fixtures are used in this room, together with a number of column candle brackets. The column lights are on independent circuits and are controlled from push-button flush switches on the columns and walls.

The ball room is illuminated by several large crystal chandeliers and a number of bracket fixtures. In the resting rooms semi-indirect fixtures are employed. Special provision is made for supplying energy for motion-picture machines. A stage is also provided, the special wiring for the same having been described when considering the riser circuits.

The main lobby which is shown in Fig. 16, is illuminated by a number of plain semi-indirect fixtures and several ornate semi-indirect fixtures, as well as column bracket fixtures. The column bracket fixtures are controlled by push-button flush switches located on the columns. On the railing of the mezzanine floor are located a number of bracket lamps. These are all on one circuit. At the desk, special cage lamps are employed, the upper cornice of the metallic cages being hollow and provided with a glass under side. In the hollow space incandescent lamps, supplied by wiring carried in conduit are placed thus casting their light upon the counters.

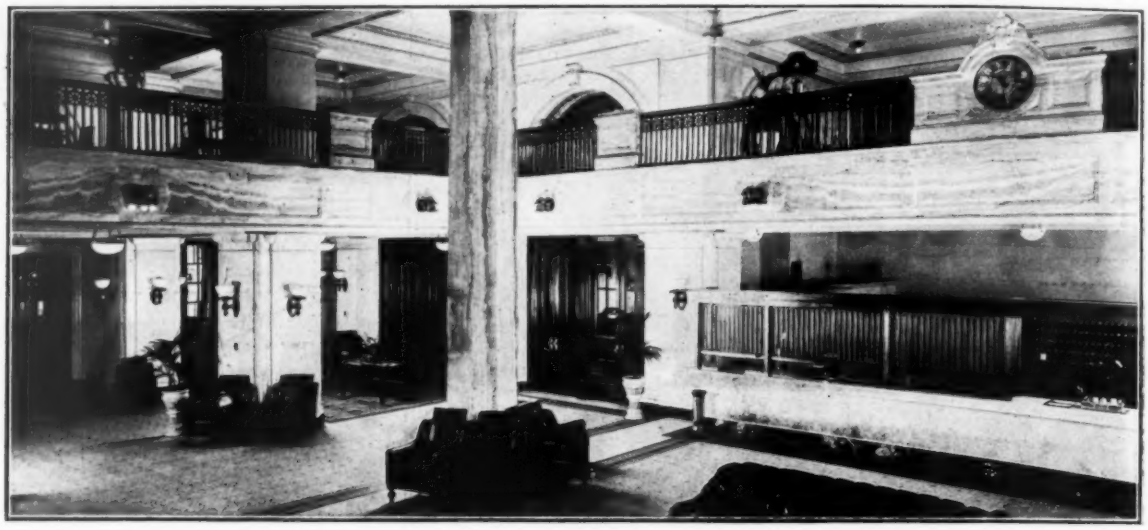


Fig. 16.—View of Lobby.

Fig. 17.—Main Dining Room.

Fig. 18.—Fountain or Grill Room.

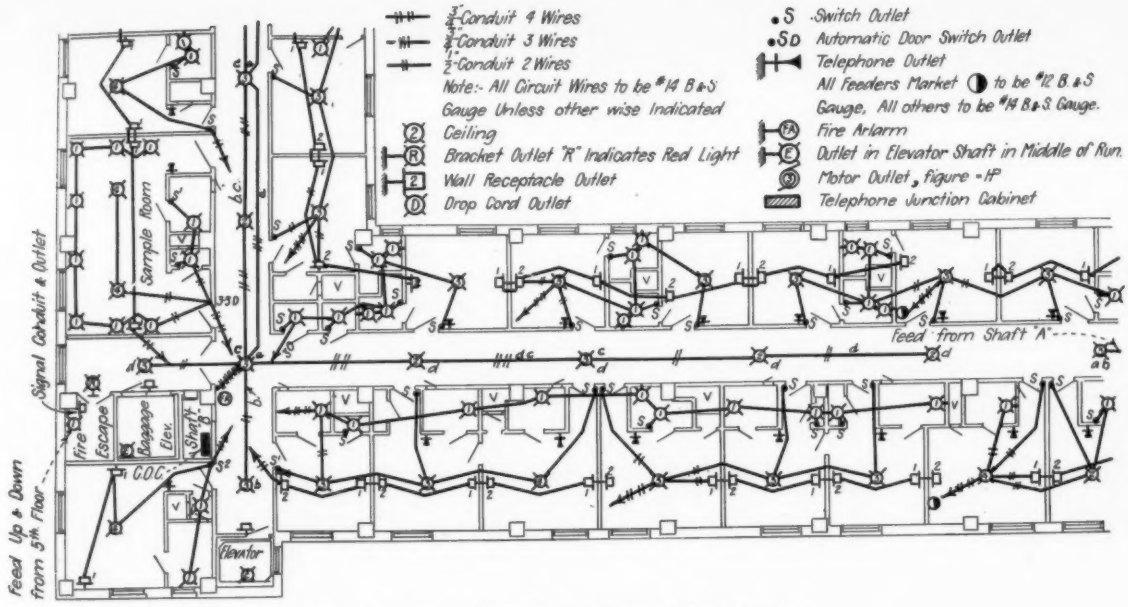

Conduit 4 Wires
Conduit 3 Wires
Conduit 2 Wires
Note:- All Circuit Wires to be #14 B.&S. Gauge Unless other wise Indicated
Ceiling
Bracket Outlet "R" Indicates Red Light
Wall Receptacle Outlet
Drop Cord Outlet
Switch Outlet
Automatic Door Switch Outlet
Telephone Outlet
All Feeders Marked to be #12 B.&S. Gauge, All others to be #14 B.&S. Gauge.
Fire Arlarm
Outlet in Elevator Shaft in Middle of Run.
Motor Outlet, figure = HP
Telephone Junction Cabinet
Signal Conduit & Outlet
Sample Room
Fire Escape
Baggage Elev. Shaft
Elevator
Feed Up & Down from 5th Floor
Feed from Shaft "A"

Fig. 19.—Wiring Diagram of Section of Typical Floor.

The mezzanine floor is equipped with numerous floor receptacles supplied by conduits carried immediately below the floor surface. These floor outlets supply current to table lamps, and to any special lamps that may be installed on special occasions, thus eliminating the necessity for running long lengths of unslightly lamp cords.

The main café has a large ellipse of lamps on its ceiling. The ellipse is supplied by four feeders, each set of two supplying the lamps on half of the ellipse.

Exposed conduit is largely employed in the kitchen and service rooms. Motors are employed for many of the operations, and special stove, refrigerator and other lamps are provided.

Numerous telephone stations are located in the hotel, each guest room, public room, and business room being provided with one or more telephones. The main telephone switchboard is situated near the desk. Telephone cabinets on the various floors are located in the wall openings for the main lighting cabinets. All telephone wires, clock wires, and signal wires are run in conduit throughout.

Anthracite Again Breaks Record.

The production of anthracite coal again broke the record in 1913, exceeding the highest previous output by nearly 1,000,000 tons, according to figures compiled by E. W. Parker, coal statistican of the United States Geological Survey. Including the coal recovered from old culm banks and a small quantity dredged from Susquehanna River, the production of anthracite for the year was 81,718,680 long tons, valued at $195,181,127.

A Few "Don't for the House Wiremen.

Don't hurry when testing out complex switch connections; it may be costly in the end.

Don't fold carpets or art squares, roll them.

Don't spend time talking to the servants, this time is not figured in the overhead expenses.

Don't when boring up from the floor below, fail to have the helper near the calculated spot where the bit is expected to appear in order to rap a warning on the floor should the bit come wrong.

Don't fail to doubly instruct the often clumsy helper that lath and plaster will not support his weight and that he should walk on the beams at all times.

Don't smoke the ceiling with a blowtorch when soldering joints, it is the mark of incompetancy.

Don't drag the coil of flexible steel-armored cable up and down the polished stairs, carry it.

Don't fail to be courteous to the residents of the house you are wiring, it may mean more business in the future.

Don't when wiring a finished house with the resident at home, fail before leaving for the day, to place in position temporarily all floor boards taken up during the day.

Don't fail to clean up at once all plaster that is cut away for outlets, it is quickly tracked through the house, and is ruinous to polished floors.

Don't watch the clock if you wish to succeed in any line of human endeavor. William E. Rhodes.

Program of National Contractors' Convention.

The annual convention of the National Electrical Contractors' Association will be held in Detroit, Mich., July 14-18, the headquarters being at the Cadillac Hotel.

On Tuesday morning, July 14, there will be a meeting of the Board of Directors and Executive Committee at 9:30 a. m.

At the morning session on Wednesday, July 15, Commissioner J. C. Gillespie, of Detroit, will deliver the opening address. He will be followed by Messrs. John Trix and W. N. Matthews, both of whom will deliver short talks. Honorable J. E. Kinnane, chairman, Michigan Industrial Accident board will deliver an address on "Workman's Compensation and Employer's Liability."

The afternoon session will be a business one and will be addressed by T. I. Jones, Commercial Section, National Electric Light Association.

Thursday morning will also be devoted to a business session.

At the business session on Thursday afternoon, S. E. Doane, chief engineer of National Lamp Works of General Electric Company, will deliver an address on the subject, "Observations of Central Stations and Contractors' Conditions in Foreign Countries."

Friday morning and afternoon will both be devoted to recreation.

On Saturday morning there will be a meeting of the Directors and of the Executive Committee. These meetings will be preceded by a business session if necessary.

Among the entertainment features will be a complimentary dinner at 12:00

noon on Wednesday, by the Detroit Jovian League, in Hotel Cadillac. Robley S. Stearnes, New Orleans, La., statesman for Louisiana, will be the toastmaster.

On Wednesday, at 7:00 p. m., there will be a Jovian rejuvenation at the Detroit Board of Commerce Building, Lafayette Boulevard and Wayne Street.

On Wednesday at 7:00 p. m., the annual dinner will be held in Hotel Cadillac, L. W. Eddy being chairman of the committee in charge.

Friday, the birthday of the Association, will be devoted to automobile rides in the morning under the direction of Chairman J. H. Busby, and to a boat trip and outing on the steamer *Pleasure* the boat leaving the foot of Bates Street at 1:30 p. m., and the excursion being under the direction of T. M. Templeton.

Fire-Protection Equipment Needed in India.

In view of the enormous losses which have lately been occasioned by fires in India, especially by the cotton fires in Bombay, and the general state of apprehension which at present exists as to the mysterious causes of such fires and the possibility of further costly disasters, the important business interests in that country would probably prove to be in an especially receptive state of mind as regards the larger use of fire-protection equipment. The time therefore seems opportune for an active campaign on the part of American manufacturers of such goods to extend their sale in India.

The total losses in Bombay alone during the present shipping season amounted to over $3,500,000 from fires in cotton bales stored for shipment. Their origin is believed by many to be incendiary. There has also been an epidemic of fires in other parts of India as well as Bombay, the cities of Calcutta, Lahore, and Simla having been visited by especially destructive conflagrations, causing the loss of goods valued at some hundreds of thousands of dollars.

Investigation has been begun by the government authorities. Soldiers have been stationed in the districts where cotton is stored, but fresh fires have frequently occurred. The prevalence of these cotton fires at Bombay will probably lead in the future to greater effort to store cotton in warehouses, which may be properly equipped with fire-protection apparatus. American automatic sprinkling devices are already used to an important extent in the best equipped mills and warehouses, and have been so successful in checking fires that the Bombay Fire Insurance Association makes substantal reductions in premiums in such cases.

ELECTRICAL INSTALLATION FOR CHILD'S RESTAURANT, LOUISVILLE.

By F. F. Valinoti.

This is the third and last installment of a report on progress in the installation of lighting and power equipment of Child's restaurant, in Louisville, Ky. This installment covers the power and lighting-circuit wiring.

The original specifications for Child's restaurant, Louisvile, Ky., called for 220-volt three-phase current for the motors, but as 220-volt single-phase current is now available in the fire district it was decided to take advantage of this fact.

There are 12 motors in all, and as nine of them are in the basement, it was deemed advisable to wire them in groups, placing several on one feeder. On the north wall of basement there was placed a six-circuit special power panel with a 200-ampere 250-volt fused main switch, meter loop and six 60-ampere 250-volt double-pole single-throw fused branch switches. This panel was placed in a surface-type No. 10-gauge steel cabinet with a steel door and trim, the door being equipped with catch and lock. This cabinet has a three-inch wiring gutter all around the panel.

The service feeder, consisting of two No. 00 stranded, double-braid wires in 1.5-inch conduit, was taken from the top of the cabinet, through the wall, and up on the outside to a point 15 feet above the alley grade. From the branch switches in the panel, feeders consisting of two No. 8 double-braid rubber-covered wires were employed to supply motors as given in the table, switches Nos. 1, 2 and 5 being reserved for future use.

Motor horsepower.	Type of connected machine.
	Switch No. 3.
1.3	Mangle.
2	Extractor.
2	Washer.
1.5	Batter mixer and bread crumber.
1	Meat chopper.
1	Coffee mill.
	Switch No. 4.
2	Ice-cream freezer.
1	Potato peeler.
1	Sterilizer.
2	36-inch roof fan.
0.25	Buffer.
	Switch No. 6.
3	Belted to 60-inch first-floor exhaust fan.
2	Direct-connected to dish washer.

Outlet boxes were used whenever it was necessary to tap a feeder, and the No. 8 wires were carried direct to the motor switches. All motors of one horsepower and over, except the two operating the fans, were equipped with double-pole double-throw motor-starting switches with running fuses. The two fan motors were equipped with 30-ampere single-throw switches and speed regulators.

The local inspectors allow the weatherproof carrying capacity of wire when alternating-current motors are installed, and when the capacity required comes in between two sizes of wire the closer size may be used. That allowed as much as 59 amperes on No. 8 wire. In figuring the size of feeders, three times the running current of the largest motor plus the running current of all additional motors on that feeder was taken as the total current, and the size of wire which carries that amount of current was used. The feeders are carried to the switches of the various motors before being reduced in size. From the switches, which had running fuses, to the motors, wires which would carry three times the running current of that particular motor were used.

The double-throw motor-starting switches mentioned above are a great protection to the motor, as the running fuses will blow under a serious overload, while under ordinary conditions with a single-throw switch the large fuse required to take care of the starting current offers practically no protection to the motor.

However, a little objection to the double-throw motor-starting switch was found due to the fact that the operators would hardly touch the starting contacts with the blades before throwing the blades over to the running side, thereby blowing the fuses. In one or two cases the switches were thrown in the running position without even touching the starting contacts. After a careful explanation this trouble was overcome, as the employees now understand the operation of the switches.

As soon as this work was completed the lighting fixtures and fans were installed. In the balcony there were installed three three-light showers and in the restaurant proper 13 semi-indirect fixtures consisting of 16-inch transparent bowls with three 100-watt Mazda lamps in each. These bowls were suspended from three nickel chains. The seven ceiling fans were also finished in nickel. In the toilet and dressing rooms nickel brackets were installed. The other outlets were equipped as described in the previous installments.

On the cashier's desk a nickel-plated push button controlling a bell in the basement was installed. For the dumb waiter return-call buzzers were installed on the first floor and basement. A bronze push button was placed beside the lift door in alley to ring a bell in basement.

From the beginning to the end of the remodeling operations eight arc lamps and 50 incandescent lamps were used to

furnish illumination for the work being done by other trades.

Work was started on April 18 and completed on June 9. During this time the average labor was man and helper for each working day. The restaurant opened for business on the morning of June 10.

Lightning a Prolific Source of Forest Fires.

Exhaustive inquiry has established the fact that lightning ranks next to railroads as a source of forest fires. Forest officers say that the increasing care with fire on the part of the railroads and the public generally, tends to make lightning the largest single contributing cause.

This statement represents a change of view from that held less than a decade ago in this country, when forest journals gravely argued whether lightning caused forest fires, though it was known that trees were the objects most often struck. Trees are said to be struck oftenest simply because they are so numerous, and extending upward they shorten the distance between the ground and the clouds; further, their branches in the air and roots well into the earth invite electrical discharges.

It seems to be a fact that any kind of tree may be struck, and the most numerous tree species in any locality is the one most likely to suffer. Other things being equal, lightning seeks the tallest tree, or an isolated tree, or one on high ground. A deep-rooted tree is a better conductor than a shallow-rooted one, and a tree full of sap, or wet with rain, is of course a better conductor than a dry one.

Lightning sets fires by igniting the tree itself, particularly when it is dead, or partly decayed and punky, or by igniting the dry humus or duff at its base. The forest soil, when dried out, ignites readily, because it is made of partly decayed twigs and leaves, and it can hold a smouldering fire for a considerable period. It is probable that most of the lightning-set fires start in the duff.

In the mountains of southern California, Arizona, and New Mexico there are likely to be each year a number of electrical disturbances known as "dry thunder storms." They come at the end of the long dry season, and being unaccompanied by rain, are very likely to start many serious fires. For this reason the forest service has to keep up its maximum fire-fighting strength in those regions until the rains are fully established. In the plans and organization for fire-fighting the service aims particularly to catch these unpreventable lightning-set fires at the time they start.

John R. Tomlinson.

John R. Tomlinson, of Pierce-Tomlinson Electric Company, Portland, Ore., is a self-made man, whose energetic effort caused him to rise rapidly from an office boy to a member of a prominent electrical contracting company. As a result, Mr. Tomlinson was recently elected national director and representative of the Electrical Contractors' Association of Oregon.

Mr. Tomlinson was born in Portland, Ore., on May 7, 1876, and received a grammar-school and business college education in that city. He was first employed as an office boy in the master mechanic's office of the Southern Pacific Railroad in Portland, but it was not long before he was transferred to the store department and later promoted to the position of division storekeeper.

But commercial business seemed more attractive to Mr. Tomlinson, so he resigned his railroad position and took a position with a local electrical

John R. Tomlinson.

dealer. Becoming financially interested in the business he rose to the position of office manager. In 1911 Mr. Tomlinson and T. F. Pierce, an experienced electrical man, formed the firm of Pierce-Tomlinson Electric Company. The new firm immediately took rank among leading and responsible contracting firms of the state.

Mr. Tomlinson has never had any training or experience as an electrician, and confines his efforts to the commercial phase of the business. From the inception of the new firm Mr. Tomlinson has taken an active and enthusiastic interest in promoting the organization of the electrical contractors of the state.

Upon the formation of the Electrical Contractors' Association of Portland, Mr. Tomlinson was elected treasurer, a position to which he has been successively re-elected. At the recent convention in Portland on June 8 and 9, he was elected as the next director to represent the association in the national convention and was instructed to attend the national convention in Detroit.

Among the Contractors.

George Hammer, of the National Regulator Company, and recording secretary of Local No. 8, Electrical Workers' Union, appeared before the Board of Education of Toledo, O., at a recent meeting of that body to protest against the letting of contracts to other than local contracting concerns. The Board declared that the contracts had to go to the lowest bidder under the laws of the state of Ohio, but agreed to recommend that the firms obtaining contracts should employ Toledo workmen wherever possible.

The Stowell Electric Company, recently completed the erection of a handsome new electric sign in front of the Hotel Jackson, Fremont, O., The sign is vertical, 20 feet high, with cross pieces at top and bottom. The sign adds to the brilliance of Front Street, which is rapidly taking on the appearance of a "Great White Way."

The Adams Electric Company, Incorporated, was organized at Youngstown, O., recently. This firm handles a fine line of chandeliers and electrical supplies and does a general construction business. Its headquarters are at 548 Market Street. E. Carlson is manager.

The Satterlee Electric Company, of Kansas City, Mo., has occupied new quarters on the ground floor at 22 East Ninth Street. The company heretofore has been located on an upper floor. Commodious display windows, which will allow the exhibition of electrical contrivances of various kinds, are a feature. W. B. Satterlee, head of the company, is the son of William A. Satterlee, general manager of the Joplin & Pittsburg Railway Company.

Eardley Brothers, the enterprising firm of electrical contractors of Salt Lake City, Utah, had as their guests the employees of their company at a strawberry and dancing festival on a recent Thursday evening. The company slogan "Let Eardley Brothers Do It If You Want It Done Right" is an ample guaranty that the evening was a most enjoyable one.

Theodore Smith & Sons Company, Jersey City, N. J., has been awarded a contract by the New York Central & Hudson River Railroad for machinery and electrical equipment for two transfer bridges at Weehawken; the contract is for $46,780.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

Opinions and Orders.—The decision of the Railroad Commission rendered within the period from July 1, 1913, to December 31, 1913, have been published in bound form. This is the third volume of decisions issued by this Commission and is published in the same form as the former volumes.

The Annual Report which has just come out in bound form is for the year ended June 30, 1913. This is a large volume containing 2,005 pages. The report contains an account of the work of the various departments of the Commission and a summary of the formal applications and informal complaints handled by the Commission. Statistics compiled from company reports are published.

ILLINOIS.

The Plainfield Telephone Company was authorized to change its schedule of telephone rates as set forth in its application to the Commission. Under the new schedule, rates for service within the village are increased $1.00 per year and the charge for switching farmer-line stations is increased 60 cents per year.

The Edwards River Power Company was authorized to issue its promissory note and chattel mortgage for $27,837.56 to the Tri-County Light & Power Company in accordance with a contract entered into between the parties. The funds received by the Edwards River Power Company are to be used in installing additional equipment to enable that company to supply the Tri-County Company with electrical energy.

MARYLAND.

The Consolidated Gas, Electric Light & Power Company. In an opinion, rendered informally, the Commission upheld the company's rule requiring an advance deposit of five dollars. The complainant refused to pay the deposit and the company declined to install a meter or furnish gas service. Upon appeal to the Commission, the complainant was informed that the company's rule is reasonable. It stated that it is a common practice for gas and electric companies to require such a deposit before giving service to a new customer. The company does practically a credit business and unless the deposit is required the company would have nothing with which to reimburse itself in case the consumer refused to pay his bill. The deposit is returnable to the consumer upon demand, should the company's service be discontinued.

NEW YORK.

Discriminations in Telephone Rates. The Public Service Commission, Second District, issued a general order directing all telephone companies in the state to immediately terminate, where the terms of contracts are terminable, all telephone service at free and reduced rates and to cease all discriminations. The Commission states that while there are hundreds of such apparent violations in cases where the jurisdiction of the Commission to deal with the matter is clear, there are a large number of cases where the telephone corporations defend the free service furnished on the ground that it is rendered under contracts existing prior to June, 1910, when the telephone companies came under the jurisdiction of the Commission. In many of these cases the corporations have installed free telephones in private residences of village and other officials under clauses in the franchise which bound the company to furnish a certain number of free telephones "for municipal use." There is doubt whether, in all cases at least, this franchise clause is an adequate defense under the statute. Provision is made in the order for companies to report all such alleged contracts which are not terminable according to the contention of the companies. Counsel for the Commission has been instructed to proceed immediately against those corporations which fail to comply with the Commission's demands to at once cease all discrimination and violations of the statutes.

The Westchester Lighting Company. The Commission, Second District, has consented to the merger by the Westchester Company of the Pelham Bay Park Electric Light, Power & Storage Company.

The Central Hudson Gas & Electric Company. The complaint requesting the company to extend service to a section of West Newburgh has been dismissed by the Second District Commission after the company had made a thorough canvass in an attempt to secure customers in this section.

The Federal Telephone & Telegraph Company, of Buffalo, was authorized to issue $500,000 par value of its seven-per-cent cumulative preferred capital stock to be sold at not less than par. The proceeds are to be used for the payment of current liabilities and for reimbursements to its treasury for expenditures from income.

The Nassau & Suffolk Lighting Company was authorized to issue $80,000, six-per-cent cumulative preferred capital stock, to be sold at not less than par, proceeds to be used for the purchase of material for its plant.

OKLAHOMA.

The Pioneer Telephone & Telegraph Company. The Corporation Commission has completed the matter of refunding overcharges collected by the telephone company under its advance in rates without authority of the Commission. It has involved the determination of the amount of refund in practically 10,000 accounts. In accounting under the Commission's direction, the company was permitted to protect itself in the matter of offsets against the refund account in cases where subscribers were owing the company and a large number of checks were for very small amounts, a number being for one cent. The telephone company, when the court decided that it must obey the ruling of the Corporation Commission, and not raise its rate without first securing permission to do so, immediately filed an application for permission to raise the rates to the basis which the company has been charging without authority.

This application was filed January 1, 1913, and bond was furnished to protect the subscribers against further excess collections, should the commission and courts finally decide that the application for higher rates was not justified.

Disposition of this application will involve a valuation of the property of the company, and a complete investigation and analysis of the results of its operation under the rates in effect. Should it be decided that the lower rates would have been sufficient to yield a lawful return upon the prop-

erty of the company another accounting and refund will have to be made. Should the application of the company be sustained the rates now being collected will become the legal rates and the company and its sureties discharged from responsibility under the indemnifying bond now in effect.

PENNSYLVANIA.

The Schuykill Light, Heat & Power Company has appealed to the Daupin County Court from the decision of the Commission in the Ashland case. The Commission's decision withheld approval of an ordinance of the borough of Ashland granting the applicant the right to render competitive service in the borough. The appeal states that the Commission erred in conferring upon the Eastern Light, Heat & Power Company monopolistic rights and in finding that the Commission had the power to impose the municipality of Ashland a public service company whether it desired it or not.

Long-Term Lease. The Public Service Commission has approved the proposed lease of the railroad, other property and franchise of the Northern Central Railway Company to the Pennsylvania Railroad Company. Similar action has been taken by the Maryland Public Service Commission and, to remove all doubt of the legality of the action, the Maryland Legislature passed a law specifically conferring the power upon the Commission. The lease provides that the Pennsylvania Railroad take over and operate the Northern Central Railway for a period of 999 years, the former company agreeing to guarantee a dividend of eight per cent on the stock of the Northern Central, pay the stockholders of the latter 10 per cent in cash out of the company's surplus and give a bonus of 40 per cent in stock of the local road.

VERMONT.

The Franklin County Telephone Company has been granted a rehearing in the matter of rates. Certain reductions in the company's rates were ordered following the general investigation of the telephone rates made by the Commission. The company asks that the rates be permitted to stand in view of certain improvements which are being made.

WISCONSIN.

The Brownton Municipal Light Plant. The Brownton municipal authorities applied to the Commission to adjust rates so as to place the plant upon a self-supporting basis, or to request that the operation of the plant be discontinued. The Commission found that the receipts of the business were only about half of the expenses and that the increases asked for would not net sufficient revenue to sustain the plant. The application for a minimum bill of $1.00 per month was denied and a 75-cent minimum charge ordered in effect. All other increases were allowed. In addition the Commission increased the street-lighting rate from $294.52 a year to $510.00 per year.

The Commission points out that the village in going into the electric business must have had in mind the amount of business which could be secured and such being the case it is not fair that all the loss of revenue should be borne by present consumers.

Protection from Competition. The Wisconsin Telephone Company applied for a certificate of convenience and necessity authorizing it to make certain extensions to its lines in the town of Anson. The Chippewa County Telephone Company objected and applied for permission to make extensions in the same territory. The Cadott Telephone Company also objected to the extension on the ground that it was already serving some of the territory. The Commission found that the Cadott Company was serving part of the territory satisfactorily and extensions of other companies into its field was not authorized. It was found that part of the territory was contributory to the Wisconsin Telephone Company's line and could be more economically served by it. As to the remaining part of the extension it was found that although the Wisconsin Telephone Company had first solicited the business, the prospective subscribers, desired Chippewa County Telephone Company service for social and marketing reasons. The application of the Wisconsin Telephone Company was accordingly dismissed and that of the Chippewa County Telephone granted in connection with the extension to this latter group of subscribers.

The Crawford County Farmers Mutual Telephone Company doing business in various parts of Crawford County applied to the Commission for authority to establish a checking station in the city of Prairie du Chien. The applicant states that it connects with two lines which run into Prairie du Chien and in order to have an accurate accounting of its business it desires that a checking station be established to which all lines running into the city would be connected.

Incidental to the above application, the company claims that it has authority to establish the checking station and to serve other subscribers in Prairie du Chien because it is at present serving subscribers in that city.

The Commission relying upon the decision of the Supreme Court of the state in Citizens Telephone Company vs. Railroad Commission, 146 N. W. 798, finds that the applicant cannot further extend its business in Prairie du Chien because the subscribers which it has at that place are merely incidental to its rural business. The Commission further finds that the checking station is not necessary and, therefore, dismisses the application. The decision was rendered June 9.

Physical Connection Ordered. The Rock County Telephone Company and the Wisconsin Telephone Company do a competing business in the city of Janesville and surrounding territory. The complaint was entered that there is no physical connection between these companies so that subscribers on one company's lines cannot use the service of the other.

The Commission in its decision finds as a matter of fact that physical connection is possible, and that no irreparable injury will be done by allowing such physical connection. Neither will it be a detriment to the service of either company. The requirements of the statute being thus fulfilled, the Commission finds that public convenience and necessity warrant the physical connection being made. The cost and upkeep are to be divided equally.

The Sevastopol Farmers' Telephone Company applied for a certificate of convenience and necessity to build a telephone line north of Green Bay, in Door County. Objections were raised to the proposed line by the Matt Peffer lines and the Door County Telephone Company, it being claimed that such line would parellel existing lines. The applicant contended that the service of the objectors was inadequate and unreasonable and that the rates were excessive. The Commission holds that where service is inadequate such matter should be brought by formal complaint. Such inadequacy of service does not warrant the establishment of a competing company if the defects can be remedied. The companies objecting had proposed to substitute metallic lines for the grounded ones in use. The Commission states in its decision that it will make a special investigation of the present service, and the application is denied.

The Fayette and Blanchard Telephone Company was authorized to issue $560 to replace a similar issue of void stock. The company had issued such void stock in ignorance of the requirement of the statutes.

The Newton-Manitowoc Telephone Company was authorized to issue $1,450 of stock, $175 of this issue being to replace void stock, and the balance to be used for making extensions.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 218.—Panama Canal Locomotives.—What reasons were considered for adopting the very low potential of 220 volts for the towing locomotives for the Panama Canal? Why was three-phase current chosen instead of direct current, which has many advantages as long as high voltage was not to be employed? Why are two very heavy and costly copper "third" rails used as contact lines? Why is the rack-rail construction such a one as to take hold of the rack pinion?—A. G., Wilkinsburg, Pa.

No. 223.—Street or Station Indicator.—Is there on the market an automatic device, usable inside of street cars, that will automatically, through electrically illuminated signs in each end or one end of the car, indicate intersecting streets by name as and when the car approaches such intersecting streets, irrespective of the number of such streets, and is the same practicable? Where is such a device used and by whom manufactured?—W. H. W., Kansas City, Mo.

No. 226.—Rewinding Motor.—How can I change a bipolar, 110-volt, direct-current, 250-revolutions-per-minute, series fan motor into a generator giving 10 to 20 volts and about 20 amperes? At present there is wound on each field one-half pound of No. 27 single cotton-covered wire; the armature has 12 slots and 12 bars and 120 turns of No. 30 double silk-covered magnet wire in each slot. I have two machines like this, exactly alike, and wish to make a motor-generator of them by changing one as indicated above.—H. J. G. J., New York City.

No. 227.—Rewinding Another Motor.—I have a General Electric one-sixth to one-eighth horsepower, 110-volt, direct-current motor, whose armature core is 3.25 by 3.25 inches and has 12 slots. The commutator has 24 segments. The original armature winding has 150 turns of No. 31 wire; the fields have 550 turns of No. 28 wire. I want to rewind it to run on 120-volt, 60 cycle, single-phase circuit. What size wire and how many turns must be used on the fields and armature?—W. T. E., Ansonia, Conn.

No. 228.—Panelboards.—Are panelboards made in which the three leads are 110-volt three-phase and all the branch circuits single phase, being evenly divided among the three phases? If such a panelboard is not on the market, could one be built with a four-wire, three-phase main, the single-phase branch circuits being connected between the three outer wires and the neutral?—J. B. E., Evanston, Ill.

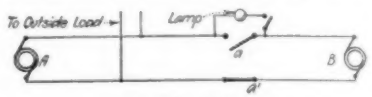
Answers.

No. 221.—Quartz Lamps on Alternating-Current Circuits—Why can the ordinary quartz-tube lamp not be used on alternating-current circuits? Are any such lamps available for these circuits?—B. W., Denver, Colo.

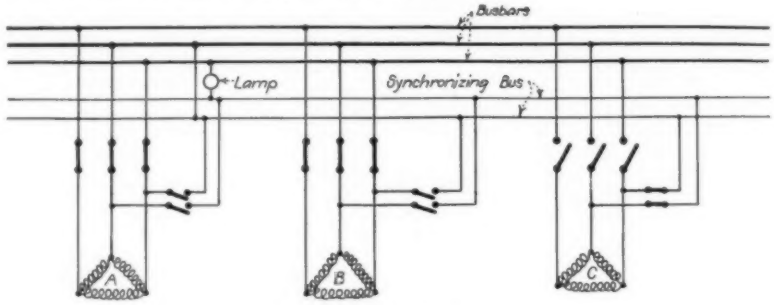
I have had considerable experience with the quartz mercury-vapor lamp and have found on the market a very reliable and dependable lamp which burns on alternating-current circuits. As a transformer is used in conjunction with this lamp, the same can be used on either 110 or 220-volt circuits, the consumption of current being about five amperes on 110-volt circuits and about three amperes on 220 volts. Owing to the extreme richness of the mercury-vapor arc in the ultra-violet rays and also to the absolute non-absorptive qualities of fused quartz to these extremely active rays, the medical profession seems to have created a considerable demand for such lamps for the treatment of skin diseases, rheumatism and kindred diseases, and for the quick healing of cuts, burns and ulcers. These lamps seem to be entirely free from any electrode trouble, the current being led in through a mercury-sealed ground joint, the conductor terminating in a reservoir never emptied of mercury, so that the arc can never touch the electrode and cause blistering or any other form of damage.—W. S. Q., Newark, N. J.

No. 224.—Alternating-Current Machines.—(A) In connecting a two-phase or three-phase alternating-current generator to a switchboard to which several other machines of the same kind are already connected, what methods may be used to insure getting the new machine in the proper phase relation to the busbars? (B) What is the purpose of the synchronizing resistance connected across the collector rings of a rotary converter while starting from the direct-current end?—P. M. B., Hudson, Ill.

(A) If an alternating-current generator is to be connected in parallel with one or more others to share a given load, it is important that at the instant of closing the switches, the voltage and time-phase of the incoming generator be the same as the voltage and time-phase of the generators to which it is to be connected. If either or both of these conditions are not met, there will be an interchange of current between the generators which may be disastrous if the difference in voltage or phase relation is sufficiently great. To see that the voltage is the same it is only necessary to compare voltmeter readings, but to insure that the incoming machine is in step with the others, more elaborate precautions are necessary. The process of bringing an alternating-current generator into step with others to which it is to be connected is called synchronizing, or "phasing-in" and the circuit by which it is accomplished is called a synchronizing circuit.

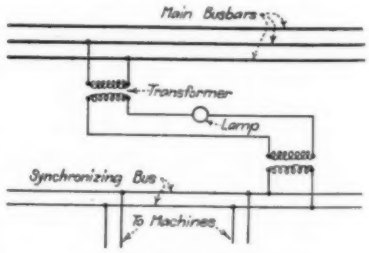


No. 224.—Fig. 1.



No. 224.—Fig. 2.

In Fig. 1, generator *A* is shown supplying current to a load. If switch *a* were closed, the two machines would be in parallel with regard to the load, but would be effectively in series with each other, and if they were not in step there would be an interchange of current between the two machines as above noted. With switch *a* open and the small switch in the lamp circuit closed any interchange of current will take place through the lamp. If the machines were 180 degrees out of phase, i. e., one generator arriving at the peak of a negative wave at the instant the other arrives at



No. 224.—Fig. 3.

the peak of a positive wave, the voltage across the lamp would be twice that of either generator since, as indicated, they are in series with each other and the lamp. For any other phase difference the voltage at the lamp would be correspondingly less, dimishing to zero when the machines are in step. With switch *a* open and the machines running at exactly the same speed, any difference in phase would remain constant and, if the switch in the lamp circuit were closed, the lamp would continue to burn. In practice, however, this condition would not obtain, as it is unlikely that the machines would be running at identically the same speed or, if they were, that they would continue to do so for but a moment. The difference in phase will not therefore be maintained at a constant amount but will vary periodically as the faster machine overtakes the slower one and the lamp will flicker accordingly. By adjusting the speed of generator *B* the flickers can be made to become slower and slower, indicating that the machines are approaching the same speed and phase relation. Now if the main switch *a* were closed at the instant the lamp was dark, i. e., when the machines are in step, they will continue in step because the machine which is running the faster will tend to run the other as a motor, thus increasing its speed and the current so supplied would act as a drag on the speed of the faster running machine, thus tending to slow it down.

Ordinarily, machines will be connected through main switches to busbars and Fig. 2 gives a diagram of three three-phase machines with a synchronizing circuit. Machines *A* and *B* are shown with the main switches closed and with the switches to the synchronizing bus open. To throw in machine *C* it is brought up to busbar voltage in the usual manner, after which the switches in the circuit to the synchronizing bus are closed, the main switches, of course, being open. When the flickers on the synchronizing lamp become quite slow, the main switches may be closed as the lamp goes out, and the machine made to assume its proper share of the load by adjusting the field rheostat. After the machine is phased in, the switches in the synchronizing circuit should be opened. It is to be noted that the synchronizing bus and circuits are connected to but one phase of the machines and main busbars, since if the machines are in step on one phase they will, of course, be in step on all of the others. The wiring will be practically the same for two-phase machines.

As noted above, the voltage across the synchronizing lamps may be twice the machine voltage and a sufficient number of lamps of the proper voltage capacity should be provided to meet this condition. If the generators were of considerable voltage, a large number of lamps would be required and to avoid this, the usual procedure is to connect the lamp through transformers of the proper ratio, as shown in Fig. 3.

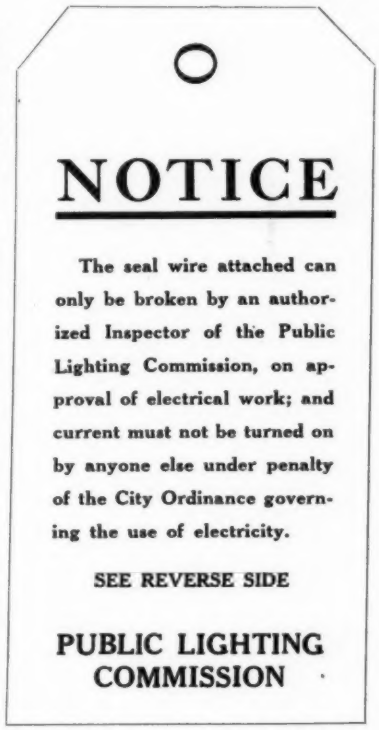
The use of lamps in synchronizing alternators has certain disadvantages. The ordinary incandescent lamp does not glow under about 50 per cent of the normal voltage and thus a rather large difference in phase might occur without any indication from the lamp. This may be obviated to some extent by reversing one of the primaries of the synchronizing transformer (or the connections between the synchronism bus and the main busbars) so that when the machines are in synchronizing the lamp is burning at full voltage, the lamp being dark when they are 180 degrees out of phase. This scheme also eliminates the possibility of a broken filament leading to the closing of the main switch with the machines out of step, but even with the circuit so connected, the lamps do not show whether the incoming machine is runing too fast or too slow.

To meet these disadvantages, modern practice usually employs some form of synchroscope, many types of which are made by various manufacturers. The synchroscope is an indicating instrument constructed on the revolving-field induction-motor principle with a pointer connected to the rotor. The pointer rotates to right or left according as the speed of the incoming machine is less or greater than that of the other machines, coming to rest when the generators are in step. Instructions for using and connecting the synchroscope are usually furnished by the manufacturer.—H. S. P., Bloomfield, N. J.

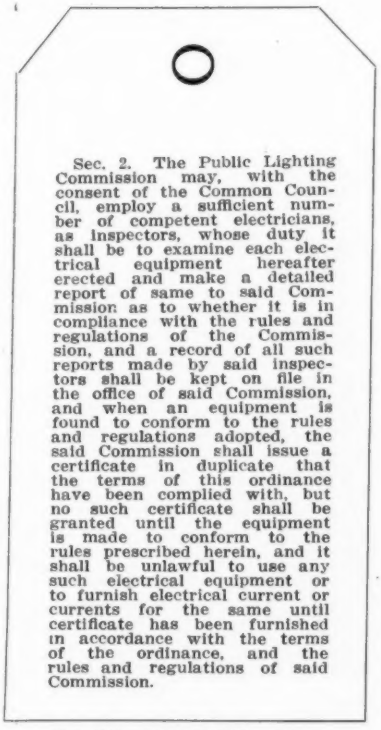
No. 225.—Blame for Faulty Connection.—A certain building was wired and pronounced O. K. by the inspector. After meter was installed (it was a three-wire job) the lamps connected to the switches on the left side of the switchboard burned out. A test showed that the neutral wire had been connected to the right-hand pole of the entrance switch instead of to the center pole, thus giving 220 volts on the left and 110 on the right. The meter man supposed that the neutral was in the center and, as there was nothing to indicate the contrary, ran the two outside wires through the meter and onto the switchboard, as is customary. The entrance wires came in through conduit and could not be traced to the outside connections. The owners of the building blame the meter man; we contend that he was not at fault. Who is right?—J. S., New Knoxville, O.

I do not think the meter man is entirely to blame, although he should know that the neutral wire enters the meter as a pressure wire only, but if final inspection was deferred until the meter and lamps were installed and before current was turned on, as is the practice in Detroit, Mich., the trouble could have been caught before serious damage was done.

Herewith is a tag which I think will explain itself, and which the Public Lighting Commission furnishes the Edison Company to be placed on all meter switches, fastening same with a seal and wire. When final approval is made the inspector brings in the tag with his report.—B. W. C., Detroit.


NOTICE
The seal wire attached can only be broken by an authorized Inspector of the Public Lighting Commission, on approval of electrical work; and current must not be turned on by anyone else under penalty of the City Ordinance governing the use of electricity.
SEE REVERSE SIDE
PUBLIC LIGHTING COMMISSION

No. 225.—Tag for Meter Switches.


Sec. 2. The Public Lighting Commission may, with the consent of the Common Council, employ a sufficient number of competent electricians, as inspectors, whose duty it shall be to examine each electrical equipment hereafter erected and make a detailed report of same to said Commission as to whether it is in compliance with the rules and regulations of the Commission, and a record of all such reports made by said inspectors shall be kept on file in the office of said Commission, and when an equipment is found to conform to the rules and regulations adopted, the said Commission shall issue a certificate in duplicate that the terms of this ordinance have been complied with, but no such certificate shall be granted until the equipment is made to conform to the rules prescribed herein, and it shall be unlawful to use any such electrical equipment or to furnish electrical current or currents for the same until certificate has been furnished in accordance with the terms of the ordinance, and the rules and regulations of said Commission.

No. 225.—Reverse Side of Tag.

Illinois Contractors Meet.

The semi-annual meeting of the Electrical Contractors' Association of Illinois was held in Danville, Ill., on June 19 and 20, the headquarters being at the Plaza Hotel and the sessions being held in the assembly room of the Hotel Savoy.

The meeting was called to order at 10:30 a. m. on June 19 by President W. J. Ball of Moline, Ill., who introduced City Attorney B. H. Snyder. Mr. Snyder extended the regrets of the mayor, W. C. Lewmann, who was unable to extend the city's welcome in person, and in the mayor's name welcomed the association to the city.

G. W. Hill, special representative of the National Electrical Contractors' Association, was then asked to deliver an informal address. Mr. Hill, after explaining his duties as special representative, spoke on the general subject of co-operation, saying that he believed the last ten years have seen an increase of about 100 per cent in the good will and co-operation existing among contractors.

The remainder of the morning session was devoted to short talks by representatives of manufacturers, jobbers and supply men. Among those who spoke were C. Brown, of the American Electric Supply Company; W. T. Clausen, of the Edison Storage Battery Company; H. Larson, of the Inland Electric Company; H. Russell, of the G. C. Richards Company; G. H. Lounsbery, of the Western Electric Company; C. Methot, of the Manhattan Electric Company; W. J. Collins, of the Faraday Electrical Association; P. Lyons, of the Indiana Rubber & Insulated Wire Company; P. F. Henchel, of S. H. Couch Company; C. R. Hunt, of the General Electric Company; E. Kerns, of the Monarch Electric & Wire Company; E. T. Ward, of the Phoenix Glass Company; E. W. Joseph, of the Electric Appliance Company; T. Endsley, of the Diamond Electric Company, and J. T. Marron, of the Electric Construction & Machinery Company.

C. Brown, of the American Electric Supply Company, emphasized the necessity of exercising extreme care in selecting the membership of any society and the necessity for all members living up to the standard of their societies. He also emphasized the need of maintaining good credit and good will in the electrical contracting business.

C. Methot, of the Manhattan Electric Company, called attention to a curve sheet published by the Manhattan Electric Company, which indicates the minimum number of circuits required for a room in accordance with rule 23. D of the Chicago electrical code which requires one watt per foot of floor surface.

W. J. Collins explained the purpose of the curve sheet and told how the same could be used.

J. T. Marron, of Rock Island, emphasized the necessity for co-operation between contractors, jobbers and manufacturers; and the necessity for each doing business only in its legitimate field. He quoted a number of incidents showing what can be done by co-operation between the various interests.

W. J. Collins, of the Faraday Electrical Association, was then called upon to make a few remarks. Mr. Collins said that manufacturers and jobbers can do much to increase the business and interests of electrical contractors. Jobbers, he said, could render valuable services to the legitimate contractors, by refusing to aid the curbstone contractor in his work and business. It should be the aim of the association, he said, to increase its membership, thus educating and aiding the non-member contractor and at the same time eliminate much price cutting due to the fact that many contractors not in the association do not employ a bookkeeping system that enables them to make an intelligent estimate.

Friday Afternoon's Session.

The afternoon session on Friday, June 19, was a closed session which was devoted to the business of the association. At this meeting E. J. Burns, now secretary and special representative of the Electrical Contractors' Association of Illinois and of the Electrical Contractors' Association of Iowa, gave a very interesting and instructive talk on the subject of liability insurance, calling attention to the results he had accomplished during the past year. Mr. Burns, who was hired by the association to handle matters pertaining to liability insurance, state licenses and all matters of legislature character, stated that the various liability-insurance companies were found to be charging electrical contractors of the state of Illinois from $1.50 to $2.00 per $100 of pay roll for liability insurance covering both the public and employees as required by law. Mr. Burns had negotiated with one of the largest risk companies in America, and was successful in obtaining from this company a uniform rate of $1.00 per $100 of pay roll for liability insurance covering both the public and employees. The average saving to electrical contractors under this rate he has found to vary from $25 a year for contractors conducting a small business to $500 a year for some of the contractors conducting a large business, the average saving being $70.36 per year for each contractor that has taken advantage of the rate. The established rate for conference companies, Mr. Burns said was $1.44 per $100 of pay roll for employees and $0.25 per $100 of pay roll for the public, making the total $1.65 per $100 of pay roll.

Considering the fact that the payroll of all the electrical contractors in the country is estimated at between $50,000,000 and $75,000,000, the value of this field for liability insurance companies is very great. Mr. Burns aims to keep the electrical contracting business from the mercy of any large liability company and hopes in time to be able to obtain all of the contractors' liability insurance.

Under the present conditions Mr. Burns does all soliciting and collecting, thus eliminating a large part of all the overhead expense common to liability companies.

Owing to the importance of liability insurance to the electrical contractor and the success of Mr. Burns in securing a low rate from one of the large liability-insurance companies, he intends to bring the subject before the convention of the National Electrical Contractors' Association in Detroit on July 15-18, so as to enable all contractors to take advantage of the low rate and to cause a nation-wide movement against the unreasonable and varying rates now being charged.

Saturday's Session.

At the closed session on Saturday morning, the reports of the Committee on State Associations and of the Committee on Membership were presented. The report of the membership committee showed an increased in membership.

A. M. Knauber, of Oak Park, Ill., then delivered an interesting address on "Central Station Co-operation," in which he told of the value of co-operation between central stations and contractors.

The meeting was then thrown open to suggestions from members. G. W. Hill spoke on co-operation and the value of organization. It was suggested that state education could well be discontinued in view of the efforts of the National Association along these lines. However, the discussion brought out the fact that the field for education was so wide that it would be unadvisable to discontinue state education at this time.

A general discussion followed on the subject of electrical contractors working with and estimating with general contractors, but the tend of opinion favored separate estimates for electrical work.

The following officers were elected: president, W. J. Ball, of Moline (re-elected); vice-president, J. T. Warren, of Rock Island; secretary and treasurer, E. J. Burns, Rock Island; board of directors: E. Pendergest, L. E. Crowley, G. Carlton; national directors: J. T. Warren, W. McGuineas and F. L. Decker.

Entertainment Features.

During the afternoon of Friday, June 19, the ladies were entertained on an automobile ride to Soldiers' Home and the surrounding country. In the evening a dance was held at Forest Park. Saturday afternoon was devoted to a baseball game between the contractors and jobbers, the contractors winning by a score of 12 to 3. On Saturday evening a successful banquet was given at the Plaza Hotel.

English Electric Supply Problems.

In the month of June every year some of the more pressing questions that are agitating the minds of managers and engineers of municipally owned electric central stations in England are brought under profitable discussion at the convention of the Incorporated Municipal Electrical Association. Here both engineers and their non-technical committeemen fraternize and confer together. This year's convention, opened at Birmingham on June 16, was in point of subjects brought forward as important as any convention of the organization.

The president, R. A. Chattock, is the city electrical engineer of Birmingham, and his address at the inaugural meeting bristled with points of interest for all concerned in electrical progress. The papers were chiefly commercial in character, and as there is perhaps no subject on which more ingenuity has had to be exercised of late than that of rate schedules, the paper by J. H. Bowden, borough electrical engineer of Poplar (London) was most timely. Under the title "Standardization of Tariffs" he set out a system of charging which he considered was, by adaptation, possible of application to any area of supply, and was a step forward in the standardization of tariffs. The principal feature of the system is that each consumer obtains the benefit of his own load-factor, or in other words, the "good" consumer does not make up for the "bad" consumer.

Another exhaustive paper coming in the same category was that of W. A. Vignoles, borough electrical engineer of Grimsby, on "The Commerical Development of Electricity Supply in Moderate-Sized Towns." He showed that electric supply undertakings were passing through a period of great development, where an energetic and pushing policy had been adopted, and the outlook for the future was exceedingly bright. The proper demand would continue to grow at a rapid rate, but it must be carefully tended and inquiries closely followed up. He showed that the sale of electricity for heating and cooking at one cent per kilowatt-hour or at least at one cent plus a demand charge, was a sound proposition, while the supply for charging vehicles should bring in a good revenue in the course of a year or two. There were financial rocks ahead of some undertakings, especially where the change from continuous current to three-phase generation was made, but this change would be to the advantage of the undertaking in the long run. If a financially sound policy had been followed the losses, to be met during the first year or two after the change could be satisfactorily faced.

The other paper was by S. E. Fedden, city electrical engineer of Sheffield, and it dealt with "Design and Operation of Modern Boilerhouse Plant."

Other features of the meeting included a supper of the Point Fives Club, and a demonstration of five firms of electric vehicles.

The presidential address by R. A. Chattock was far from being one of merely local interest, its several sections covering, among other matters, contract conditions, installation work, electric-vehicle progress, the need for a new electrical organization, centralization of electric generation, etc.

On the vexed question of the aspiration of the municipal electricity authorities to secure Parliamentary authority to carry out installation work, Mr. Chattock considers that failure to come to agreement with the contractors was due to the action of those who are opposed to wiring being carried out by municipal supply authorities under any circumstances whatever. He believes that contractors exaggerate the quantity of work that it would be possible for a municipality to undertake if it secured the powers now being sought.

"First of all, we seek these powers not for the purpose of securing more trade, but to ensure good work, especially in the cheaper classes of installations. The expensive work in hotels and good-class business houses and residences, which is well paid for, is, as a rule, well done. Moreover, there is the wiring work for telephones and bells which the contractors must obtain, because the municipality has no power to do it and does not seek such powers, with the result that a customer will probably prefer to place the whole order with one person instead of two. In addition, the contractor can calculate the profit on the whole combined order, and he could probably successfully compete in price with the municipality. With the cheaper work, the case is entirely different, the margin of profit is so small that the quality of work often suffers, and the men who do it, as a rule, are not worth going for if trouble results. It is this jerry work that we want to eliminate. If we obtain the power we seek, we shall be able to put to the contractors who are at fault that they must do good work or we will do the work ourselves. There is surely nothing to be alarmed at in this."

The single fact that some electricity-works engineers have shown themselves unfriendly to the contractors should not be allowed to influence the general body of contractors. "Supply engineers, in order to hold their positions, must be good business men and I cannot imagine a good business man following a policy of opposition and unfriendliness toward the contractors operating in his area. If he does such a thing . . . . he will not occupy such a responsible position for any length of time." A satisfactory agreement is still hoped for. "It is unthinkable that supply undertakings can do without electrical contractors."

Passing on to consider the progress of the electric-battery-vehicle movement in England, President Chattock impressed upon his hearers that manufacturers of these vehicles could not give extended trials in more than a few towns. Yet it was only by bringing and keeping these vehicles before the public that interest would be aroused; he therefore holds that supply undertakings should be prepared themselves to bear some of the cost. Municipalities ought to practically demonstrate by using electrics for street cleaning, collection of house refuse, conveyance of supplies between departments, etc. Money so spent would amply repay the electrical undertaking. "There is no doubt that in a large city many thousands of pounds of revenue will be obtained annually from the use of these vehicles when their adoption becomes general, and the sooner we engineers take pains to push their use, the sooner will our revenues be augmented."

The Industrial Committee of the Institution of Electrical Engineers having found it impossible to do work it desired in advancing the interests of the electrical industry, because it had not adequate powers, has been dissolved, and the industry is therefore now without any organization capable of co-ordinating and supporting the work of sectional associations. As a member of that now defunct committee Mr. Chattock thinks that some body should be called into existence which would be capable of offering its services in the event of disagreements arising between different interests, such as, for example, the electrical contractors and the central stations. A central association formed from all the associations connected with the electrical industry could arrange conferences to consider disagreements between individual associations, and, if necessary, arbitrate upon them; it could be called together by any individual association requiring support in its operations, whether political or industrial. That such an organization would be of inestimable advantage to all branches of the industry, Mr. Chattock is fully convinced; but he also recognizes that the Institution of Electrical Engineers cannot deal with disagreements so well as the suggested organization, as it has so many and varied interests to represent.

The possibilities of combining gas and electric undertakings under one

control does not commend itself to Mr. Chattock's mind; he holds that there is a field for both.

The growing importance of centralization of electric supply was among the other present-day themes touched upon in the address. The signs of the centralization movement are present in London where both the companies and the municipalities have been considering it, and they are also evident in the provinces where the larger municipalities have been extending their boundaries, taking over plants situated in the acquired areas. Parliament recognized the principle when it gave authority to the big power companies to serve large areas. "All these instances are steps in the right direction, though we are as yet a long way off the goal—where it will be possible to obtain, all over the country, and at one rock-bottom price, a supply of electrical energy for any purpose, such as power, heating, lighting (and this will ultimately be such a small percentage of the whole that the poor load-factor can be safely ignored), domestic requirements, traction by rail, road, or tramway, etc. The provision of cheap power and cheap transit for both goods and workmen are essential to a manufacturing nation. Germany and America both recognize this and England "must do the same unless we are content to take a back seat in the future." Centrally controlled systems of supply are imperatively necessary and Parliament, in Mr. Chattock's opinion, should "tackle the question of nationalization" under one authority. There can be no further marked reduction in the cost of electrical production and distribution until some such scheme is brought into operation.

It is only by tackling the problem boldly, by being prepared to supply current at prices much lower than are ruling at present, and recognizing that for a few years there must necessarily be a deficit on the large initial capital expenditure incurred, that it will be possible to attract and develop the large volume of business that will be necessary to make such a scheme a financial success in the future. The following are its outlines:

"Large bulk-supply power stations should be installed in various parts of the country, having regard to the three following chief requirements: proximity of an ample quantity of coal; proximity of an unlimited supply of water for condensing purposes; proximity of the various large centers of industry where the major portion of the energy is likely to be required. Railways, of course, cover practically the whole of the country, so that these can be fed economically at any point or points throughout their length. As soon as these bulk-supply stations are available and the distributing trunk cables installed, the majority of the small generating stations in the country should be at once shut down and utilized as substations. It would probably be found most satisfactory to, in many cases, adhere to the existing methods of distribution, and to utilize these as far as they will serve, possibly, as they become filled up, installing alongside of them other schemes for distribution of energy which may prove more economical to handle."

There need be no fear that engineers would have to be dispensed with when these stations were shut down. The object of the scheme being to increase business in all these centers by giving supply at a more attractive price, the men on the spot had the best knowledge required, and the chief engineers in charge would be especially valuable in this direction. "We electrical engineers have to be managers of our business as well as engineers in charge, and the business control is every bit as important as the engineering control. The commercial side of the business is so dependent upon technical matters that it is necessary to have an engineer at the head."

Mr. Chattock closed his address by formulating a definite proposition. As the scheme is so vitally important to all industrial centers, it is in their own interests that the large municipalities who at present control the major portion of the bulk supplies in the provinces, should meet together and discuss the matter, and if possible formulate a satisfactory scheme which could be brought jointly before Parliament, to be subsequently developed on proper commercial lines. His justification for advocating this method of procedure as the most suitable was the supply of electrical energy for all purposes, whether industrial, domestic, or public utility at a price far below what is now being paid: (*a*) for the benefit of the community as a whole; (*b*) for enabling manufacturers to compete successfully with foreign competitors; (*c*) for the abolition of smoke and the consequent improvement of health; (*d*) for the conservation of coal supplies by more scientific and economical utilization; (*e*) and for sustaining the British commercial position.

Increase in Wireless-Telegraph Business.

Steady progress in the wireless telegraph business is shown in the annual report of the Marconi Wireless Telegraph Company directors for 1913. The net profit for the year amounts to $185,145; the revenue from ship telegrams, subsidies, etc., amounted to $731,580, an increase of nearly 50 per cent over 1912.

REGULATION AND REASONABLE RETURNS.[1]

By Halford Erickson.[2]

This discussion relates to state regulation of public utilities and to what constitutes reasonable returns for interest and profits in such enterprises. In other words, it deals with the nature of such regulation and the principles upon which it rests, as well as with the nature and justification for interest and profits and the facts and conditions that should be considered in their determination.

The laws under which public utilities are regulated by the state cover a broad field. Among other things they provide that the services rendered by the utility must be adequate, and that the rates charged for such services shall be reasonable. They also provide for the establishment of commissions for the enforcement or administration of these laws

What constitutes adequate service and reasonable rates are among the questions that in the cases that come before them are passed upon by such commissions, and their findings upon the points involved are usually set forth in the rules, regulations and orders that are promulgated by them. Thus it is usually found that a service to be adequate must conform to certain standards and that a rate to be reasonable should yield enough, under normal conditions, to cover reasonable amounts for operating expenses, depreciation and for interest and profit, and be free from unjust discriminations. Under these rules the cost of the service becomes the basis for the rates that the public pays for the service. That is, the receipts from the rate schedules of utilities when taken as a whole, should cover the charges named and should be so adjusted that each branch of the service and that each class of customers in each branch are made to bear their just share of these charges.

The findings of such commissions are thus, as a rule, based upon facts and are for the most part closely adjusted to existing conditions. These findings are also changed whenever important alterations take place in these facts and conditions. In these respects there are important differences between state and local regulation. For under the latter the conditions as to service and rates are mostly subject to franchise provisions covering long periods of time and which as a rule are not altered during these pe-

1 Portion of paper presented at convention of Michigan Section, National Electric Light Association, June 17.

2 Member of Wisconsin Railroad Commission.

riods regardless of the changes in the facts and conditions that may take place in the meantime.

Regulation was first established for the protection of the public. Until recently little if anything was ever said about any protection for the utilities. Whether this was because the utilities were thought to be fully able to protect themselves or because no serious encroachment was ever made upon their rights, is not clear. As time went on, however, the situation changed. Today the statutes themselves as well as the decisions thereon by the courts provide protection for the utilities as well as for their customers. The ostensible purpose of regulation now is to establish equitable and fair conditions between the public on the one hand and the utilities on the other. It has come to be seen that those who serve the public as well as the public itself may need protection; that it is in the end to the best interest of all concerned that proper protection be extended to both.

It is in matters relating to the returns to the investors and to the enterprisers that the principal differences exist between ordinary competitive enterprises and regulated public utilities. In competitive enterprises no limit is placed upon interest and profits. Those engaged therein are usually allowed to make all they can. In the utility field, on the other hand, the rates charged for the services are prohibited by law from being so high as to yield more than reasonable returns.

This leads to the question what constitutes reasonable compensation for the services rendered by such utilities. This is a question that is much discussed at present. In its broadest sense it covers the share of each factor that assists in providing and furnishing the service. In a more limited sense it usually covers interest and profit. In order to determine the question in either case it is necessary to appraise the property and business of a plant, and to analyze its operating expenses, including depreciation, and returns for interest and profits.

The fair value of a utility is as a rule determined from facts that show the original cost and the cost of reproduction, not only of the property used, but of the business as well, due consideration being given to the depreciation that has taken palce in the property. Both the original cost and the cost of reproduction thus constitute evidence of value. The weight that should be given to each of these two lines of evidence is a matter that depends upon the circumstances. In some cases and for certain parts of the plant the greatest weight may have to be given to the original cost. In other cases and for other parts again the cost of reproduction may lead to the fairest results. Appraisals must also at times be made when only one of these two sets of facts are available, and even in such cases it is possible to arrive at a fair value. For experience shows that for plants that have been constructed from time to time, or when prices were higher as well as when prices were lower, the original cost and the cost of the reproduction of the property in use are seldom far apart. For utilities with a short life, such as electrical and telephone plants, the greater part of the property is seldom more than a few years old and is therefore likely to have been constructed under conditions that do not vary greatly from those under which an appraisal is likely to be made.

The operating expenses proper are also subject to measurements. They have their causes and their results both of which upon analysis throw much light on the amount that is needed for operating the plant. There are also many other ways in which the fairness of the different items may be tested. What is thus true for the operating expenses is also true for depreciation. This item depends mostly on the cost of the property and upon its useful life in years. It is also effected by the cost of removing the discarded property and by its scrap value. There is little if anything about these outlays that cannot be determined with a fair degree of accuracy.

When it comes to that part of the cost of the service which is covered by the returns for interest and profits many different views are encountered. This is particularly true in the many rate controversies that are arising from time to time. In such cases those who represent the municipality or the public often hold that no more should be allowed for interest and profit than the rate at which the municipality could borrow the necessary capital, when it pledges all of its taxable property and when the loan is supported by its full taxing power. Those who represent the plant frequently argue that no restriction whatever should be placed upon these returns and that the plant should be allowed as much for these purposes as it can earn when the rates for the services rendered are fixed at all the service can bear. It need hardly be said that these views represent the lower and the upper limit, rather than the fair rates. The reasonable or normal rate of returns is undoubtedly found somewhere between the two extremes.

We are mostly accustomed to look upon interest and profits as the difference between the sum of the operating expenses, depreciation and taxes on the one hand and the total gross earnings on the other. These returns are in fact made up of interest on the capital used, insurance against risks, and profits for the enterpriser. The insurance against risks, however, is seldom treated as a separate factor, but rather as a part of the other two. Those who furnish the capital receive interest as a compensation for the service rendered by the capital. The enterprisers who assume the risk and responsibilities for the management receive profits as their share for the services they perform. For both of these factors the rate of these returns are higher in risky than in comparatively safe undertakings.

The economic theories underlying interest and profits are quite complicated and can only be touched upon here. It is generally understood, however, that both capital and the enterpriser are factors in production; that these factors like the other two factors, land and labor, cannot be had without compensation; and that such compensation, is, in each industry, governed very largely by the demand and supply.

The demand for capital varies with the opportunities for its profitable employment. It is as a rule greatest in and comparatively undeveloped countries and during periods of general activity of business in all lines. The supply of capital also generally varies with the return it brings. Capital is obtained by savings and it is an economic fact that such savings are the greatest when the rates of interest are the highest. In other words, more capital is saved and turned over for use in productive enterprises under high than under low rates of interest.

The normal rate of interest is, perhaps, the rate at which capital in any given industry can be had when the demand and supply of capital about offset each other. This is especially true when the operation of the laws of supply and demand is not unduly restricted by either legal or artificial barriers. In risky undertakings the rates of interest are higher than where greater safety obtains. The reason for this is that investors will not assume extra risks without extra returns. The lowest risks are found in government bonds on which the rate of interest may not exceed 2 or 3 per cent. From this point up the rate rises with the risk, and also for the reason that the amount of work and foresight required in managing or looking after the investments are much greater where risks are taken than when little or no risks are involved.

Profits have their source in the business ability, skill and foresight of the

enterprises or in their management. The enterpriser is a sort of an economic buffer who bears the shock and often much of the losses in case of failure and who also reaps the credit and much of the profits in case of success. To successfully exercise the functions of an enterpriser a high order of ability is required. Such a man must have organizing capacity of a high order, be a good judge of man, and have tact in dealing with them; he must have the command of financial resources and the ability to plan and execute commercial and industrial policies; he should also have the technical knowledge that is required to adopt the best methods, outline the most economical processes and to properly pass upon materials and products.

Profits are usually made up of wages of management and compensation for risks. The wages of management that are thus included in profits may among other things cover the work of bringing and holding the factors of production together, of organizing the enterprise, of co-ordinating the work or business as a whole, and of exercising general supervision over the business. In the larger undertakings the profits are mostly made up of compensation for risks since the greater part of the cost of the managerial work, is as a rule, included as general charges in the operating expenses of the concern. In the smaller undertakings, on the other hand, it covers as a rule not only the compensation for the risks but all the compensation for the work of management as well.

The wages of management vary with the business, the ability, skill and amount of work required, the legal restrictions that surround the business and with many other conditions. When industrial society is progressing and when in each succeeding period there is therefore more wealth to be divided among those who share in the product than in the preceding period a large part of the increase is likely to go, at least temporarily, as extra profits to the enterpriser. In the same way when industrial society is retrogressing the loss falls first on the enterpriser. Their greatest share at any time is all they can make. The minimum is the amount the enterprisers could obtain elsewhere working for wages. In the long run, however, the wages of management must be high enough to encourage men of the necessary ability and skill to enter the field.

When the risks are small the compensation therefor is also, as a rule, small. In such cases the profits may not greatly exceed the wages of management. In such enterprises the profits are also apt to be still further reduced when a part at least of the wages of management is charged directly to operating expenses. In the long run, however, the compensation for risks will not fall below the point at which a sufficient number of enterprisers are found who are willing to assume it.

The rates and terms upon which the necessary capital and business ability can be had are matters that depend on the location of the plant and on the conditions generally by which the plant is surrounded. They are likely to be higher and more liberal for entirely new projects than for new extensions to existing plants. The larger undertakings with established earning power, the securities of which have a ready market, can, as a rule, obtain capital on better terms than smaller plants whose securities have no regular markets.

Public utilities should be well regarded by the investor. The services they render have become necessities, since the public cannot do without them and since no effective substitutes are available. Such utilities are also for the most part free from active competition, partly because they are protected by a franchise and partly because it is now becoming generally understood that one utility can serve a community better and at lower rates than two or more utilities. They are entitled to reasonable rates for adequate service and a reasonable rate under normal conditions is usually a rate that will yield fair returns on the investment. When their rates are lower than this, they may be raised; nor can their property be confiscated. Their business goes on in in good times and bad, and is not often seriously affected by general business depressions. As a rule, they earn good returns on a fair value of their property. If their securities do not exceed this value then they should be safe. Such securities also have a constantly widening market, fair price stability and yield a fairly good income.

But even in face of this they are not wholly free from risks nor from all other objectionable conditions. The conditions which surround their construction and operation are often such that costly mistakes therein may easily take place. Serious accidents resulting in costly injuries to persons and to property are often occuring in connection with their construction and operation. The community served may grow less rapidly than was expected and for which preparations had been made. It may even fail to grow at all or its growth may be in unexpected directions. All this may make parts of the investments more or less useless and result in idle capacity and many other losses.

The best evidence of the compensation that is paid for capital and business ability in various undertakings under different conditions is usually found in the prices at which the various classes and kinds of securities of such undertakings are selling in the market; the relation between these securities and the investment therein; the earning power of these undertakings, and in the rates of interest on various classes of loans that prevail from time to time. The prices at which such securities are changing hands take account not only of the value of the investment in an enterprise, but of its earnings and the cost of all the factors of production.

In order to obtain facts of this nature I have investigated a large proportion of the more representative bond and stock issues of public utilities that have been offered to the public during the past few years.

Ten representative first-mortgage bond issues covering electric lighting and street railway plants brought out in 1913, bearing interest at the rate of 5 per cent, were placed on the market at prices under which they would yield the investor an income of from 5 to 6 per cent. The cost to the issuing company of obtaining this capital amounted to from 1 to over 11 per cent for discounts, and to about 3 per cent for selling expenses, or to a total of about 6.2 per cent as an average. In these cases I was not able to obtain absolute figures as to the cost of reproducing the plants and business; but as the issues were taken by responsible bond and banking houses, whose practice it is to appraise the property behind the securities they handle; to determine the earnings from which the interest and dividend charges must come, and to keep the issues within safe margins, I feel it can be assumed that these issues were regarded as well protected.

During the same period ten representative second-mortgage bond issues, covering gas and electric lighting and street railway plants, bearing interest at 5 per cent, were offered at prices that would net investors an income of from about 5 to 6.2 per cent. On these issues the discounts varied from 1 to over 12 per cent, and the selling expense stood at about 3 per cent. The total cost to the companies of this financing ranged from 5.2 to about 7 per cent, the average being about 6.4 per cent. Second-mortgage bonds are not as well regarded as first-mortgage bonds and often for good reasons. They must be resorted to.

however, in order to obtain capital for new extensions when the first mortgage is closed. Generally speaking, the best policy is to make the first mortgage cover as much ground as possible and then hold the bonds in escrow until needed for additions and improvements.

Twelve note issues were offered to the public at prices that placed them on a 6.2 per cent income basis to the investors. When the discounts and selling expenses were taken into account, the cost to the companies of the funds thus obtained is found to be about 9.4 per cent per annum. In this case the discounts ranged from less than 1 to about 2.34 per cent. The selling expenses, however, were rather heavy, since they appear to have ranged from about 5 to over 8 per cent. Five preferred-stock issues were sold on a basis on which the average yield to the investor was about 7.30 per cent. Since the discounts varied from 3 to 12.5 per cent and a selling expense also had to be met, the cost to the companies was, of course, much greater than the price to the public.

For about 40 plants in our state, the appraised value of which varied from about $20,000 to about $2,000,000 per plant, the bonds, when discounts and selling expenses are included, have of late years been selling at prices under which the cost of financing to the plants ranges from about 5.5 to fully 6.5 per cent per annum. In these cases the bonds covered from 50 to more than 85 per cent of the value of the plants and their business, while the net earnings of the plant did not amount to less than twice as much as the interest on the bonds. If in these cases the stock issues had been limited so as to amount to no more than the difference between the sum of the bonds and the total value of the plants; if interest at the rate of about 6 per cent had regularly been paid thereon, and if from time to time it had also received something in the way of extra dividends in some form it is quite likely that these shares would have sold rather readily at about par.

Stocks come after the bonds and are therefore less well secured. Stocks are therefore selling on a higher income basis than the bonds by which they are preceded in order to compensate the investors for the extra risks they assume.

The public utility securities thus described are on the whole well secured, not only by the value of the property behind them, but by the fact that the earnings for years have been much greater than the amount actually required for interest and dividends. Had the security been less good and the earnings lower, then these securities would also have sold at lower prices and would have yielded higher returns to the investors. The best protected issues from the point of view of safety and earnings thus sell at the highest prices and yield the lowest returns to the investors.

The conclusions to be drawn from the principles and facts that have thus been presented can perhaps be illustrated as follows. A public utility, the plant and business of which are worth about $1,000,000, of which $800,000 is represented by bonds and $200,000 by stocks, and having net earnings above the operating expenses, depreciation and taxes of $75,000 per annum, or 7.5 per cent on the value, would likely be able to sell its bonds on about a 5.5 per cent basis and its stock on something like a 6 per cent basis, provided the conditions are such that these earnings are likely to continue in the future and provided further that the stocks from time to time would receive something in the way of extra dividends or rights. In this case the interest on the bonds would require $44,000 each year, or about 42 per cent of the net earnings, while the dividends paid on the stock would absorb about $12,000 annually, or about 39 per cent of the surplus for dividends, which surplus amounts to about $31,000. If the value behind these securities and net earnings thereon had been less than the amounts thus given the securities would also have sold at lower prices or on a higher interest or income basis than those outlined. The cost to the public of the capital and of the enterpriser in this case is thus represented by the net earnings of the plant. It appears from these facts that in the public utility field, even under favorable conditions, it is not safe to assume that interest and profits will require less than 7.5 per cent on the fair value of the plant and its business.

From the facts thus presented it will be noticed that the cost of capital alone in the public-utility field is thus considerably higher than the rates at which municipalities or cities can borrow money when the loan is supported by all the taxable property of the city as well as by its full taxing power. For, as we know, cities, under such circumstances, can usually obtain money on its bonds at the cost of from 4.1 to 5 per cent.

When cities issue special improvement bonds on the other hand, secured only by the property effected or the income therefrom, and not by the general taxing power, they must pay fully as much in interest as the amount paid by public utilities. This is illustrated by the situation in the city of New York, where the money for the construction of the new subway is furnished by the city, which can borrow all the money it needs for the purpose at not over 4.25 per cent when these loans are supported by its taxing power. When the city found it convenient some time ago to have the construction or operating company furnish a part of the capital it was found that, although the securities issued by this company for the purpose, were given the first claim upon the earnings of the subway, not only for the interest charges, but for a sinking fund large enough to amortize the loan in a comparatively short time, they were not taken by the investor at better prices than on a basis on which they yielded considerably more than 5 per cent in the way of income, or about 1 per cent more than the rate at which the city could have borrowed the money.

In other places it has also been found that bonds assumed by the cities in purchasing utilities, as well as special improvement bonds sell at much lower prices than the bonds of the same cities that are supported in full by the taxing power.

In view of such facts as these it would almost seem idle to argue that public utilities should be allowed no greater return for interest and profit than the rate at which the city could borrow the capital under its full borrowing and taxing power. Yet such arguments are often heard and seriously advanced both before commissions and elsewhere.

In order to prevent injustice to anyone it may also be necessary in dealing with returns for interest and profit to give some consideration to the tendency and the course of prices for money, commodities and lab The reason for this is that these returns depend upon the rates charged by the utilities for the services they render and that these rates in turn depend on the cost to the utilities of furnishing the service. For instance, it is often found that rates fixed during years when the costs per unit of service were low and which then yielded reasonable returns, have become too low to yield fair returns shortly afterwards because of increase in the costs per unit due to advancing prices. It is true that in a growing country tendencies of this sort are often partly, if not wholly, offset by decreases in the costs per unit due to increases in the volume of the business. Of late, however, the increases in the cost per unit, due partly to advance in prices and partly to advance in the cost of operation arising from new additions

to the plants and extensions of the service which, though needed, have not been accompanied by corresponding increases in the earnings, have often been so great as to lead to material declines in the net earnings. Many rates made a few years ago not only by commissions, but by the utilities themselves, are now too low. The situation that has arisen in this way is very embarrassing. In many cases, however, it might have been avoided if greater consideration had been given to the trend of prices and the needs of the service, and if in this and other ways proper allowance had been made for future conditions.

A few facts illustrating the course of the rate of interest and of prices may not be out of place. In the rate of interest there was a gradual, though often interrupted decline, from about 1890 to about 1904. Since 1904, however, the tendency has been upward.

Not only have interest changes increased during the past decade, but the capital itself has been hard to get, even when extra inducements were offered for it. While this is partly due to the fact that the supply of available funds has not kept pace with the demand, it is also, in a measure, due to the fact that investors and bond houses are gradually becoming more discriminating and are constantly demanding wide margins of safety and more complete information concerning the value and the earning capacity back of the securities they buy. Many have also looked with apprehension upon the rapid extensions of government interference in various ways, and have, therefore, shown some timidity in their ventures. While government regulation of security issues in the long run is of much value to the bona fide investor, this value is not as yet generally understood. At the same time it is also a fact that to the ultra speculator such regulation is a hindrance rather than an advantage.

It is evident that increases in the cost of furnishing the service unless accompanied by increases in the earnings means lower returns for the enterprises and perhaps also for the investor. When such advances in the cost are due to causes over which the management has no control and when they result in lower than reasonable returns to those who are responsible for the business, then injustice is done. If this condition is not remedied and the plant is compelled to go on and furnish service for less than paying rates, the result will be that new capital will not enter the field; that needed extensions to the plant will not be made; and that adequate service will not be furnished. The public will in fact fail to obtain the service it needs and upon which it depends. A situation like this is neither fair, nor in line with public policy. It should be remedied if necessary by providing more earnings through higher rates. In fact, it is as much in line with public interest to raise rates that yield less than reasonable returns as to lower rates that yield more. At any rate this is the case except perhaps under peculiarly abnormal conditions.

At this point I would like to call attention to a matter that seems to me important. As has been stated herein, capital is not easily obtained even by plants whose securities are sound. This is particularly true for the smaller plants that are not connected with any of the larger interests or holding companies. These difficulties in securing capital will delay, if it does prevent, needed extensions and improvements. It also tends to raise the cost of the capital. The important question is how can this situation be improved? There is one way it seems to me in which this could be done, and this with great benefits to all concerned. It could be done by issuing $100 bonds instead of $1,000 bonds and by selling them to small investors, especially the customers of the plant.

The bonds of public utilities would seem to afford such investors the opportunities they are looking for; provided, of course, that they are issued in the right amounts. Such bonds when kept within the value of the plants are serving well established communities have a most excellent record for safety. They also yield the the investors much better incomes than the savings banks. While not free from hazards and other drawbacks they offer many sound investment opportunities. When everything is considered it would seem that they might be made as safe and become as attractive for the investment purpose thus outlined as any bonds that might be named.

Besides opening up new avenues for obtaining capital this method of investment would enable the utilities to place their bonds where they would do the most good, or among their customers. If so placed it is almost certain that closer relations between the utilities and the public would be established. The importance of this is readily seen. It might often be the means by which many a strained situation could be converted into more harmonious ones.

While under state regulation of public utilities the returns for interest and profits in this field will be kept down to a reasonable level, the reasonableness of these returns is not measured by the bare rate of interest at which municipalities can borrow money, but rather by the amounts for which the capital needed for the enterprises can be had. This means that in the long run these returns for such utilities will be about the same as those that may be obtained in other enterprises, where the conditions are similar.

This is the doctrine of reasonable returns as it stands today. While the processes by which it has been developed have been painful and slow it is in line with the best economic, legal, and ethical principles. Regulation from these points of view is the putting into effect of principles that are inherent in just government everywhere and in all generations. These principles are implied in the whole fabric of the common law, and this fact should enhance rather than otherwise the high plane upon which the doctrine rests and the conscientiousness and care by which it should be administered.

Memphis Electrical Show.

The first electrical show given under the auspices of the Jovian League of Memphis, Tenn., was very successfully held from June 15 to 20. Through the kindness of Herman Rhodes, president of the Rhodes Furniture Company, the new building of this concern was placed at the disposal of the Jovians and the show was held there. Special decorations were provided, in which electrical illumination played a conspicuous part. The show was entirely free to the public and was very well attended. Many prizes of electrical appliances and utensils were given, which helped make the show exceptionally popular.

Contributing to the success of the show was the hearty co-operation of the electrical contractors of the city, the Memphis Consolidated Gas & Electric Company, the Memphis Power Company and other electrical interests in the city. Musical entertainment was provided each afternoon and evening. There were also given a number of popular lectures illustrated with stereopticon views.

Among the exhibitors were the following:

American Pre-Pay Fan Company.
Automatic Telephone Company.
Burroughs Adding Machine Company.
General Electric Company.
O. K. Houck Piano Company.
Lilly Carriage Company.
Memphis Street Railway Company.
Mottley Brothers.
Thordarson Company.
Tri-State Wireless Company.
Western Electric Company.
Westinghouse Electric & Manufacturing Company.

MODERN DEVELOPMENTS IN POWER GENERATION.[1]

By Paul M. Lincoln.

One of the complaints which we are continually hearing these days is the increased cost of living. An analysis of the various items which enter into the cost of living in these modern times will show that unquestionably the cost of living has been materially advancing during the past few years. However, there is one notable exception and that is in the cost of electric service. The cost of electric service has been continually going down. With the earlier central stations, 20 cents per kilowatt-hour was not an unusual price to pay, but the rate has been steadily reduced so that in these times, lighting rates are in almost no case above 10 cents per kilowatt-hour, and in some cases are as low as 5 cents per kilowatt-hour and even lower, and for power where electric service is used in comparatively large quantities, the rates are only a relatively small fraction of that which is required for lighting.

In casting about for a reason for excepting the rates for electric service from the other items that enter into the cost of modern living we find that there are two main reasons that may be logically assigned:

(1) The bettering of the economies of modern central stations as compared with those of former days.

(2) The large increase in the volume of electric service of modern central stations as compared with former ones.

It is difficult to say which of these reasons has the greater weight. They are largely interdependent, since the bettering of economy has come about, to a very considerable degree, due to the demand for larger volume.

Considering first the bettering of economy, the things which have particularly contributed to this are:

(1) The general adoption and use of the steam turbine.

(2) The very large increase in the size of units which has occurred in recent years.

(3) The increased attention to the bettering of efficiency in the burning of fuel.

Let me take these up in order.

In dealing with the range of steam pressure from boiler down to about atmospheric pressure, the steam turbine has a slight advantage over the reciprocating engine. Its main advantage within this range is that since it requires no cylinder lubrication, a higher degree of superheat is available than with reciprocating engines, where it is necessary that the cylinder walls be lubricated. Aside from this the steam turbine does not use the steam through this range of pressure to a very much higher degree of efficiency than does a reciprocating engine. However, when we come to consider the relative economics of steam from atmospheric pressure down to the vacua that are used in modern central-station work, the turbine has a very great advantage over the reciprocating engine. With a turbine it is possible to make use of the expansive power of the steam clear down to the highest vacuum that can be produced; on the other hand, with the reciprocating engine it is impossible to use the expansive power of the steam much higher than a 25 or 26-inch vacuum without making the mechanical parts unduly large and expensive. In other words, with the reciprocating engine, it does not pay to expand the steam below a point corresponding to a 26-inch vacuum, while the same objection does not apply to the steam turbine. This fact allows the steam turbine to obtain a very much larger proportion of the available energy in the steam than is possible with the reciprocating unit.

It is true that the steam turbine is available for power purposes only when used in conjunction with the electric generator. This comes on account of the inherently high speed of the steam turbine. The steam turbine is inherently a high-speed machine and the use of the electric generator is the only practical way in which the power of the steam turbine can be made available for general purposes. The exception to this general statement is the utilization of the power of steam turbines on shipboard and in a few other instances, by first reducing the speed of the steam turbine through special gearing. However, the fact that in general the power of the steam turbine can be utilized only through the agency of an electric generator is not a handicap since, in these modern times, the general utilization of electric service has made this by far the most convenient as well as the most practical method of thus utilizing the available power of steam.

Another thing that has contributed largely to the bettering of economies has been the large increase in the size of modern units as compared to those of former days. Probably the largest reciprocating units ever built, at least in physical dimensions, were those which were installed about 1898 in the power house of the Manhattan Elevated Railway Company in New York, now a part of the Interboro Rapid Transit Company. These units had a nominal capacity of 5,000 kilowatts, but later were found to have the possibility of being rated very considerably beyond this figure. The generators operated at 75 revolutions per minute and, as most of you know, had an outside diameter of over 40 feet. At the time they were installed, they were the most modern and up-to-date generating units ever built. Although they are today just as good for the purpose of generating power as they were when first installed, the advance of the art has left them so far behind that within the past year the Interboro Rapid Transit Company has decided to take out four of them, in which space there is room to install four 30,000-kilowatt turbine generator units. The fact that in the space thus vacated by this old type of reciprocating unit, there is space to install units having six times as great a nominal rating is, in itself, evidence of the rapid growth of our industry. The 30,000-kilowatt units, which are now being installed, have a water rate of 11.25 pounds per kilowatt-hour as against 18 or 19 pounds per kilowatt-hour for the old reciprocating generator units when used alone. Single units of as high a capacity as 35,000 kilowatts have been sold, and that more of such units, or even larger, will follow in the future is only to be expected. This follows naturally from the very large capacity that some of our modern central stations have attained. For instance, the Commonwealth Edison Company, of Chicago, has attained a peak load of nearly 300,000 kilowatts. When considering such tremendous quantities of power, a single unit of 30,000 or 35,000 kilowatts is entirely logical and with the increases in station outputs that are bound to come, it is only logical to expect that still larger single units will be demanded in the future.

Increased attention to the economies of burning fuel is also responsible for the bettering of power-plant efficiencies. The fuel bill amounts in most central stations to somewhere between one-half and three-quarters of the total operating costs. This fact alone makes it desirable that close and careful attention shall be given in order to secure the utmost returns for a given amount of fuel burned. In modern stations the economies of the boiler plant are given much closer attention than they have been in the past. Steam meters on individual boilers, CO_2 recorders and other refinements in boiler practice have done much towards bettering the economies of our modern central stations.

In order to express in general terms the improvement which has taken place in the modern central station, we may say that for the old-time reciprocating station a thermal efficiency of 3 to 5 per cent was about what was usually obtained. By this I mean that from

[1] Address at a meeting of Pittsburgh Jovians.

3 to 5 per cent of the energy resident in the coal was actually put into the busbars. Contrast this with the statement which was given to me a few days ago by Mr. Stott of the Interboro Rapid Transit Company, probably the most efficient central station in the country. He stated that the thermal efficiency which he was obtaining was about 15 per cent. In other words the modern central station can utilize from 3 to 5 times as much energy from a given amount of coal as could its predecessor of the early days. This, therefore, gives a concrete idea of the bettering of economy which has been secured with our up-to-date modern central stations.

It is not amiss, however, to call attention to the fact that the bettering of economy has been called for by the tremendous increase in the volume of modern electric service as compared with those of the earlier days. When electric service was first inaugurated, it meant simply electric lighting and nothing else. In the modern central station electric lighting is but a small part of the total service rendered, and further the amount of electric lighting in a given community has increased tremendously over what it used to be. If you will inspect the growth curves of almost any central station, you will find a tremendously rapid growth during the last ten years. A station which does not show from 10 to 20 per cent increase in output of any one year over the previous year is rather unusual, and a 10 to 20 per cent increase in annual output continued for a period of 10 to 15 years means a total increase which is simply appalling.

For instance, the City of Chicago demands for its central-station service a load which reaches a peak of nearly 300,000 kilowatts. The aggregate of all the loads of the central stations in and about New York City will amount to at least 500,000 kilowatts. These tremendous outputs, when compared with those of ten or fifteen years ago in the same centers, of themselves tell the story and give the reason why electric service in the modern times is one of the few items which has not risen with the other items that enter into the cost of living.

Transit Company Inaugurates Self Insurance.

The Brooklyn Rapid Transit Company and the Edison Electric Illuminating Company, of Brooklyn, N. Y., recently announced that they have decided to establish a system of self-insurance in complying with the new workmen's compensation law. This was based upon the belief that the premiums of insurance companies would prove excessive when compared with the risks involved.

A Squantum Club Clambake to Electrical Men.

H. N. Fenner, president of the New England Butt Company, the pioneer manufacturer of machinery for insulating electrical wires, annually invites as his guests to the famous Squantum Club Clambake, on Narragansett Bay, near Providence, a number of New York friends. The most recent of these events was celebrated on Wednesday of last week. So that electrical men may realize what fare is provided, the luncheon and dinner menus are given as follows:

LUNCHEON.

Little Neck Clams in Shell
Lobster Salad
Small Fish Balls
Lettuce Sandwiches Butter Sandwiches
Lamb Kidneys, Madeira
American Cheese Crackers
Doughnuts
Dampeners

DINNER.

Clam Bouillon
Clam Chowder Fish Chowder
Clam Fritters Brown Bread
Clams
Bermuda Onions Sweet Potatoes
Imperial Punch Frappé Tom and Jerry
Cigarettes
Fried Eels
Tartar Sauce
Sea Bass, Stuffed
Potatoes Natural
Lobster
Julienne Potatoes
Indian Pudding and Cream
Watermelon
Edam Cheese
Roquefort Cheese Toasted Crackers
Coffee

Among the gentlemen in attendance who, after amply satisfying their appetites, are gradually finding their way back to New York City, were Messrs. W. L. Candee, H. Durant Cheever, George T. Manson, and William H. Hodgins.

Incorrect Meter Reading Subject to Correction by Court Verdict.

The Court of Errors and Appeals, Trenton, N. J., has handed down a decision affirming a judgment recently obtained by the Borough of Vineland, operating an electric light and power station, against its consumer, the Fowler Waste Manufacturing Company, involving a condition of incorrect meter readings. For a period of two years the chief electrician, it was held, failed to multiply the elctric meter dial readings by the meter constant of 10, during which time the consumer consequently was charged for only one-tenth of the electric energy actually used; upon discovery of the error the Borough sent the Fowler company a statement for the remaining nine-tenths current not included in regular monthly bills during the period.

Failure of voluntary payment necessitated court action by the Borough, to which the company interposed a claim of equitable estoppel. The company held that the amounts actually paid in response to the erroneous bills were used in calculating its overhead expenses for arriving at the cost of production and establishing the selling price to be charged therefor. It was thus claimed that the company having during this period sold its product at prices accordantly based, could not equitably be subjected to the loss incident to a change in its production cost, because of a mistake for which it was in no way accountable.

The court, in its decision, stated that this specific claim was not upheld inasmuch as testimony was also given that the company sold its products at the highest price obtainable.

Louisville Electrical Clearing House.

The Louisville, Ky., Electrical Clearing House, which has heretofore been under the auspices of the Kentucky Actuarial Bureau, is to be organized on an independent basis. At the meeting last week the matter of striking out independently of the insurance interests was referred to the executive committee, C. C. Childers, president, F. G. Burdorf, vice-president, and E. C. Knoop, secretary, with instructions to report at the July meeting. The organization of the electrical workers and contractors has filled a long felt want in Louisville and the members are fully aware now of the benefits they will realize from it.

The next meeting of the organization will hear also the report of an augmented committee on conduits. Three men theretofore had been considering that proposition but further consideration was required. A report will also be received by a committee of fixture men on the insulating of canopies. The last meeting saw a discussion on the matter of modifying the loop-system requirements which are in force in Louisville, but members declined to consider any letting down of the bars.

Akron to Secure Utility's Water Rights.

The expenditure of over $500,000 is involved in the proposed contract, under consideration between the city of Akron, O., and the Northern Ohio Traction & Light Company, by which the company will convey to the city its water rights in the Cuyahoga River. The city is preparing to open a new water plant, and unless it secures the company's water rights will be seriously handicapped in the amount of water it will be permitted to use. A contract has been prepared under which the city may take all of the water it now needs for $348,000, with the option of excluding the company entirely within the next 20 years for the payment of $152,000 additional. The city is prepared to accept this plan, rather than risk the delay involved in litigation.

BOOK REVIEWS.

"Die Elektrischen Eigenschaften und die Bedeutung des Selens fuer die Elektrotechnik." By C. Ries. Berlin: *Der Mechaniker*. Paper, 189 pages (6½x10 inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for $1.00 in paper and $1.25 bound.

This work, which deals with the electrical properties of selenium and its importance in the electrical industries, is a second and considerably enlarged edition of Dr. Ries's earlier book upon the same subject which was published in 1908. Starting with the discovery of selenium in the year 1817 by the Swedish scientist, Berzelius, as a by-product from the distillation of sulphuric acid from iron pyrites, and dealing with its physical and chemical characteristics, Dr. Ries discourses upon the action of light, heat, moisture, ozone, X-rays, Becquerel rays, wireless waves, etc., upon the selenium cell. A large number of curves are published illustrating not only the author's own work, but that of other investigators in this field, such as Ruhmer, Pfund, Korn, Luterbacker, Marc, Schrott, Sperling, Corpini, Glatzel, Athanasladis, Reinganum, Wulf and Lucos.

Illustrations are shown of a number of well known types of cells and nearly all the forms known today are described in the subject matter. Various scientific and industrial applications of the selenium cell are also shown, and the text goes more or less fully into its application in photometry, telegraphy and wireless, picture transmission, seeing at a distance, gas buoys, the photophone, the telephonograph, eclipse measurements, etc.

A bibliography, catalog of literature gone into, and a list of authors at the back of the book, and an index of titles in the front constitute this as one of the most useful books which have thus far been published dealing with the properties and applications of the selenium cell.

W. J. HAMMER.

"Regulation, Valuation and Depreciation of Public Utilities." By Samuel S. Wyer. Columbus, O.: The Sears & Simpson Company. Flexible leather, 313 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for $5.00.

Few of us are yet used to a standard book printed on India paper and for this reason we are, upon hasty examination, apt to conclude that Mr. Wyer's very comprehensive book upon "Regulation, Valuation and Depreciation of Public Utilities," is an interestig pamphlet and dismiss it as such. As a matter of fact, it is a standard book of over 300 pages, and in arrangement, illustration and index it is unusually complete. It perhaps covers more ground than any general book upon the subject of regulation and valuation, and is particularly strong in its concise fundamental definitions. The book should be useful in any consideration of electric, water-power, gas and natural gas, telephone and railway freight rates. The special chapters upon depreciation and electrolysis are a noteworthy contribution to the general subject. The arrangement of referring to a selected bibliography collated as an appendix, by a single number in the text, is very useful and references to court and commission decisions are treated in a like manner.

I know of no book that would give such a complete grasp of the subject, to any one wishing to make an initial study of regulation and valuation. Its value is also great as a complete and handy reference book for the experts upon the subject. The book may be subject to some criticism upon each of the important subjects, but a very close examination of the references given by Mr. Wyer shows that he has used such references with great care and with such a spirit of fairness that such criticism is disarmed. Every author in such a textbook must select his references, and Mr. Wyer has accomplished this part of the work with great skill, for if all references are given in a book of such extended scope as this, we would have instead of a textbook, an encyclopedia, and our only gain would be in size at the expense of less real value. This book should be in the library of every utility company, commission and others dealing with utility problems.

WILLIAM J. NORTON.

"American Electricians' Handbook." By Terrell Croft. New York: McGraw-Hill Book Company, Incorporated. Flexible leather, 711 pages (4x6¾ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for $3.00.

This volume is especially suited to the requirements of electrical contractors, wiremen and the electricians in industrial plants. Its scope is quite different from that of previous electrical handbooks, as may be seen from the following list of sections: Fundamentals; Generators and Motors; Outside Distribution; Interior Wiring; Transformers; Illumination. Not only the principles of operation and construction of the machinery are given, but the common troubles are pointed out, with methods for their localization and correction. Many data are given in the form of tables showing the requirements in wiring and in choice of motors for various applications. The section on outside distribution takes up the construction of both overhead lines and underground conduit, while the section on interior wiring covers the more common materials and the various methods of installation suitable for different types of buildings and the requirements under various jurisdictions. The use of molding, knobs and tubes, and conduits are all fully explained, and much useful information given with respect to the wiring of electric signs, of bell annunciator and burglar-alarm systems, of telephones and of gas-lighting circuits. The wiring of old buildings is specifically taken up. The section on illumination gives a general description of the various forms of lamps and the general principles to be followed in laying out lighting installations. The author has made liberal use of sources of information already available, and many selections are made from articles which have appeared in technical journals and from material published by manufacturers, associations and others. Credit has been given to the sources of information, and a number of references are given to which the reader can refer for complete information upon certain of the subjects considered. For the class of readers for which the book is intended and for the objects in view in its compilation, the reviewer knows of no more satisfactory book of reference than this handbook. Naturally a few errors have crept into the first edition of a volume of this magnitude, but these are few in number and not of a serious nature. The explanation of the terms "series-multiple" and "multiple-series," appearing on page 108, has been somewhat jumbled; incorrect units have been given for the measurement for resistivity; and an incorrect statement has been taken from another author in explaining the application of Ohm's law on page 14. The volume is well illustrated and the diagrams chosen are well executed and add greatly to a clear understanding of the points illustrated. This volume should be in the hands of every individual in the classes above mentioned, and will be found useful to a great many others involved in any way in electrical work.

"Practical Illumination." By Justus Eck. London: S. Rentell & Company, Limited. Paper, 85 pages (4x6½ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc. for 40 cents.

While this volume is denominated by its author as a pocketbook for engineers, contractors and others interested in the application of electric lighting, it seems to treat the subject in too superficial and elementary a way to be so designated. The fundamental ideas to be observed in lighting are very concisely and simply stated and much information is given which will prove of most value to those who are not already supplied with more comprehensive books on this subject. After some preliminary chapters dealing with the more fundamental factors connected with light and its applications, the author takes up the lighting requirements of different interiors and gives some brief directions for planning an installation. In this connection there are some useful tables, including data on the cost of installation and maintenance.

New Electrical and Mechanical Appliances

New Stripping Pliers.

Of much interest to all electricians are the new stripping pliers added to the extensive "Red Devil" line of linemen's and electricians' tools manufactured by the Smith & Hemenway Company, Incorporated, 150 Chambers Street, New York City.

The illustration readily shows the many advantages and the general utility of this tool. The stripping is accomplished by means of two stripping blades, set one in each member of the

New Stripping Pliers.

tool, immediately behind the head. The body of the blades is threaded, permitting the most minute adjustment. This feature permits their use both for cutting and stripping insulation, as either the narrow cutting edge can be put on the insulation, or the broad stripping edge put in contact with the wire. Each pair of pliers is accompanied by a screw-driver for adjusting the blades, which are renewable.

When it is considered that the stripping features of this tool can be had in addition to regular flat-nose and side-cutting pliers, it can readily be seen that the Smith & Hemenway Company is maintaining is reputation of leadership for its "Red Devil" line of linemen's and electricians' tools, which represents over 3,000 styles, sizes and finishes.

New Universal Portable Electric Grinder.

The Standard Electric Tool Company, Cincinnati, O., has placed on the market a new grinder of the aerial type for surfacing rough castings, and for buffing.

This tool has a universal motor that operates on both alternating and direct current with equal efficiency, being interchangeable. It is especially adapted for low-frequency current, such as 25, 30 and 40-cycle circuits. The motor is form-wound and impregnated in Bakelite, which method of winding and insulation prevents short-circuits, grounds and other troubles, incident to high-speed apparatus if constructed according to slow-speed motor practice. The motor has capacity of one-half horsepower and is very durable and efficient.

The speed is 6,000 revolutions per minute. The tool is fitted with an emery wheel four inches in diameter, with one-inch face. Ball bearings are employed throughout, the best imported types being used. The tool is very effective on alternating current, owing to its high speed, and is much more productive and economical to operate than air grinders. Workmanship and material are of the very highest grade, and the tool will stand the most rigorous continuous service.

This grinder is furnished with a spring for suspending from the ceiling, and it can be used in connection

New Aerial Type Grinder.

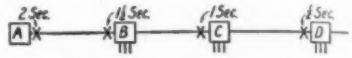
with a traveler and counterbalance. The motor will run off either lamp socket or power circuit, being furnished with connecting cord and plug for either one.

A government commission has recommended that instead of elecrifying the existing railroad between Santiago and Valparaiso, Chile, at an estimated cost of $11,193,000, it would be better to build a new electric line connecting these two important cities.

Overload Relays.

Continuity of service is an essential consideration in all installations, and interruptions of the service cannot be tolerated unless the protection of the apparatus demands it. When they do occur, they must be confined to the smallest area possible. The time-element features of the overload relay, which is described below, facilitate this.

Two forms of overload relay are supplied. Both have an inverse time element. In one of the forms, which has been on the market for some time, the relay trips instantaneously at extreme



Selective Action of Relays.

overloads. In the new form there is an adjustable definite minimum time element. This definite minimum can be adjusted for any point from zero to two seconds in the standard relays, and special relays can be supplied giving up to 10 seconds minimum.

The definite-minimum time-element relay provides a selective action where substations are placed in series at intervals along a transmission line, clearing the circuit at the last substation between the trouble and the generating station. Thus, suppose a generating station *A*, in the accompanying diagram, with relays set for two seconds minimum, and substations *B*, *C* and *D* in series, with relays set for one and one-half, one and one-half second minimum, respectively. If a ground or short-circuit occurs beyond *D*, the relay at *D* cuts off the trouble section before the others operate so that the rest of the line remains in operation; if trouble occurs between *C* and *D*, the relay at *C* will cut off the trouble; and so on.

Another use of the definite-minimum time-element relay is in relieving circuit-breakers. It is well known that the ultimate breaking capacity of a circuit-breaker depends on the time of breaking. If a ground or short-circuit can persist for two seconds before the circuit is opened, the ultimate breaking capacity is doubled, that is, the strain on the breaker is reduced to half, owing to the drop in voltage and current during the interval.

This overload relay is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Electrolytic Iron for Cores.

Fisher's process of preparing sheets of electrolytic iron for use in the manufacture of transformers, motors, etc., is being utilized by Langbein and Pfannhauser, Leipsig, Germany. This material has excellent magnetic properties, especially with respect to permeability. The price is less than twice that of the special transformer iron heretofore used.

Test results upon this material were given recently by M. Breslauer in the Elektrotechnische Zeitschrift. Hysteresis losses are extremely low and may be taken as about 10^5-B^2 watts per kilogram at 50 cycles per second. Owing to its high electrical conductivity the electrolytic iron shows high eddy-current losses. It has, however, the advantage that it can be obtained in very thin, flat plates, giving a smooth surface, free from oxide. Using plates 0.01 inch in thickness, the total iron losses in a dynamo when operating at 50 cycles, 10,000 gausses, 70 degrees Centrigrade, were found to be 1.66 watts per kilogram, as compared with 2.8 watts per kilogram with ordinary plates of double this thickness. In the case of a transformer core under the same conditions, the iron losses were found to be 1.23 watts per kilogram, as compared with 1.45 watts for alloy plates of thickness 0.016 inch.

A comparison of two 30-kilowatt transformers designed for operation at 50 cycles, one using electrolytic iron and the other special alloy plates, was given as follows:

	Electrolytic.	Alloy.
Flux-density, gausses	13,000	9,000
Weight of iron, pounds.....	339	535
Weight of copper, pounds...	113	181
Relative cost.....	100	127

In transformers with artificial cooling, full advantage can be taken of the high permeability of electrolytic iron and the losses on overload decrease, owing to the high temperature-co-efficient of this material.

A similar gain cannot be obtained in armatures by the use of electrolytic iron, since the teeth are ordinarily worked to saturation anyhow, but a saving may be effected in the field poles. In the cases of one 300-kilowatt machine, the weight of the fields was reduced 22.5 per cent by using electrolytic iron in place of cast steel.

The following table shows the magnetomotive force in ampere-turns per centimeter required to produce various flux-densities in the different irons, and shows the great advantage of electrolytic iron in this respect.

Flux-Density in Gausses.	Electrolytic Iron.	Ordinary Iron.	Special Iron.
7,000	0.4	2 to 4	2
10,000	0.7	5 to 6	5.5
15,000	4.0	24 to 32	52.5
18,000	72.	146 to 180	260

The town of Walsall, near Birmingham, England, is preparing to borrow $364,258 to erect a new electric supply works to meet the demand for electricity and to replace a plant which has been found to be obsolete.

Two Interesting Motor Installations.

An interesting motor-driven stoker equipment is installed at the plant of the Austin Manufacturing Company, Harvey, Ill. A 250-volt one-horsepower Type 1S Electro Dynamic motor is used to drive a McKenzie stoker during the day and at night is used as a generator to supply current for the engine-room lights and the night lamps in the shops and offices.

Fig. 1 shows the arrangement of the stoker, motor and boiler. The boiler is a 293-horsepower Sterling water-tube boiler, operating at 150 pounds steam pressure. This boiler supplies part of the steam delivered to a 500-horsepower DeLaval steam turbine driving a 250-volt Crocker Wheeler generator of the same capacity. This generator supplies the necessary energy for power and lighting during the day.

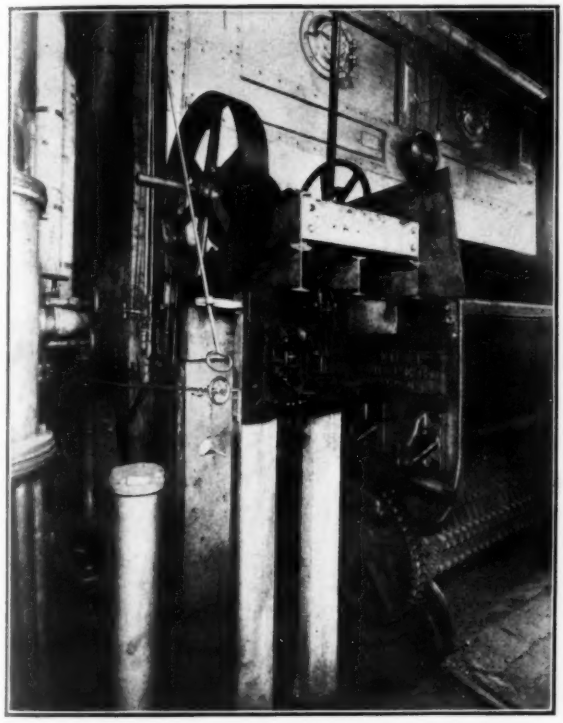


Fig. 1.—Stoker, Motor and Boiler at Harvey Plant.

Fig. 2.—Side View of Equipment Showing Operation.

The boiler consumes on the average about 7.5 tons of Harrisburg slack furnace coal per 12-hour day. This coal is fed to the furnace from a hopper by means of a McKenzie chain stoker running at a speed of about 5 feet per minute. As shown in Fig. 2, this chain revolves about a drum to which a worm-driven gear is attached. The worm shaft is driven by means of a ratchet and pawl, the latter being connected to a driving rod driven through reduction gearing from the motor. The motor is of the ball-bear-

ing type and operates at a speed of 425 revolutions per minute.

At night the motor gearing is thrown out of mesh and a belt connected to a small steam engine is thrown on the motor pulley, thus converting the motor into a generator for supplying the night lamps. The small steam engine obtains its steam from a small auxiliary boiler. The motor, which is of the interpole type, operates equally as well as generator or motor without shifting the brushes. When operating as a motor a Cutler-Hammer starting rheostat with no-voltage and overload release is employed. The motor is manufactured by the Electro-Dynamic Company, Bayonne, N. J.

A similar motor, but of a variable speed type, is installed on the second floor of the Baldwin Piano Company's offices in Chicago, Ill. This is a 220-volt interpole Type 2S shunt Electro Dynamic motor having a speed ratio of two, that is a speed variation of from 625 to 1,250 revolutions per minute, and a rating of 3.5 horsepower for continuous service and five horsepower for two hours' intermittent service.

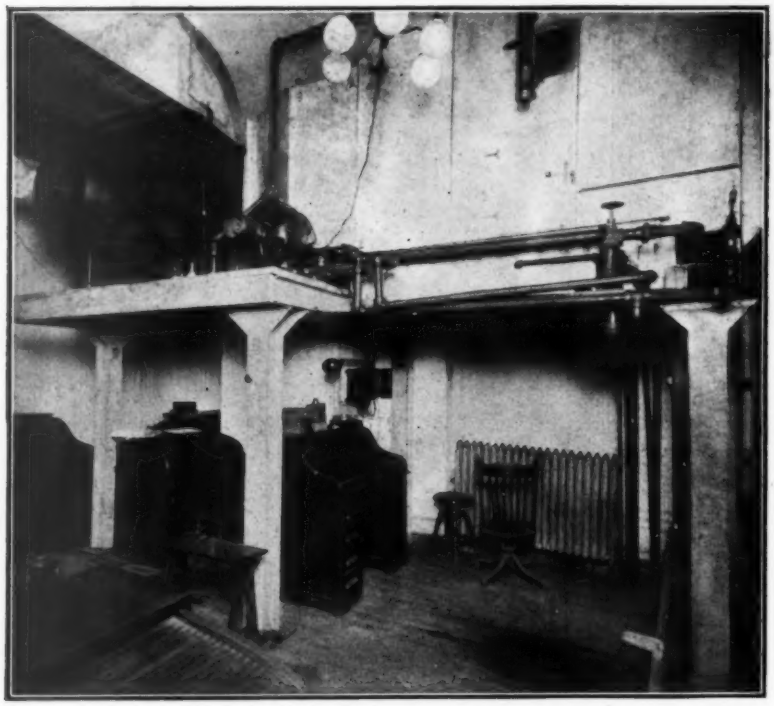


Fig. 3.—Motor-Driven Ventilating Equipment.

Fig. 3 shows that this motor is used to drive a ventilating equipment, being belted to a No. 55 Type B Seri-Vane fan which in turn is belted to a small centrifugal water pump supplying water for a cooling and dust-removing spray in the air intake. This motor is also of the ball-bearing type and is controlled by a 3.5-horsepower Cutler-Hammer shunt-motor controller and a field rheostat which is used to reduce the motor speed to about 750 revolutions per minute.

At this motor-speed the fan delivers about 9,000 cubic feet of air per minute, causing a complete change of air every seven minutes in the three player-piano rooms, the two player-piano music rooms, a lavatory, a den and a large office.

Allis-Chalmers Absorption of Bullock Concern Almost Completed.

The work of completing the various details involved in the absorption of the Bullock Electric Manufacturing Company, of Norwood, O., by the Allis-Chalmers Manufacturing Company, of Milwaukee, Wis., which has heretofore controlled it through stock ownership, is under way, and it is expected that it will be completed by July 15.

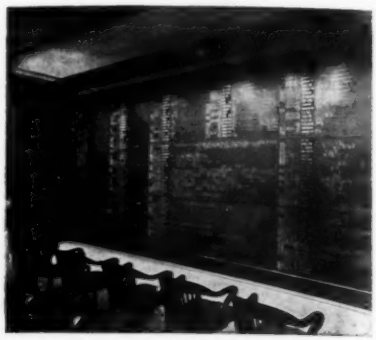
All of the bonds of the Bullock Company are to be redeemed in cash, its stock issues being taken care of by bonds and cash. Under the plans of the reorganization being followed the Bullock Company is entirely absorbed by the Allis-Chalmers Manufacturing Company, its assets being over and its securities liquidated.

The automatic telephone system recently installed at Simla, the summer capital of India, has been working so satisfactorily that the service has become extremely popular.

THE LIGHTING OF STOCK QUOTATION BOARDS.

By J. L. Stair.

The first requirement to be met in a special lighting problem of this kind, is that of providing even illumination



Quotation Board Lighted with Scoop Reflectors.

over the entire surface of the board, so that figures and quotations may be as easily seen at the bottom of the board as at the top. Again an intensity of illumination must be provided sufficient to enable the marks on the board to be seen from any part of the room.

It is very desirable also so to arrange the lighting system that no lamps or reflecting equipment are visible, since nothing can be more uncomfortable than to attempt to watch the operations of the stock-quotation board, with numerous glaring lamps in plain view.

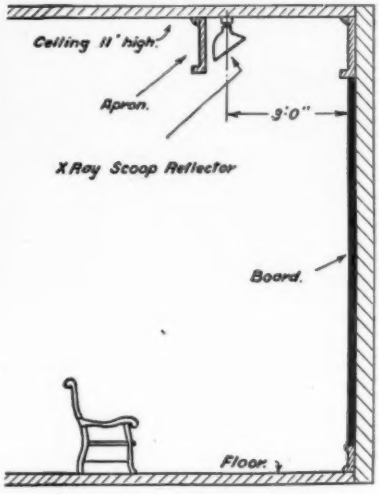


Diagram of Lighting Equipment.

Ordinarily there is a waste of current in the lighting of quotation boards, more lamps being used than are necessary. This waste can be easily eliminated by using care in the

selection and placing of lamps and reflectors.

In the installation shown herewith, the requirements for good lighting have been admirably met. It should be noted with what distinctness the figures on the board stand out, and how well the bottom of the board is illuminated. The question of concealing the lamps was simplified by the fact that a beamed ceiling was used in the room. It was only necessary therefore to build in an additional, or false beam, near the board and parallel to it.

This beam, which is in reality only an apron, is about three feet from the wall, and drops down in front of the conduit and reflectors which direct the light upon the board. The beam is finished in mahogany to conform with the woodwork and trim, and at the rear of the room is easily mistaken for one of the beams making up the ceiling construction.

The relative location of the lamps is shown by the sketch. X-Ray scoop reflectors were installed and spaced about two feet apart, with 60-watt tungsten lamps burning in a pendent position.

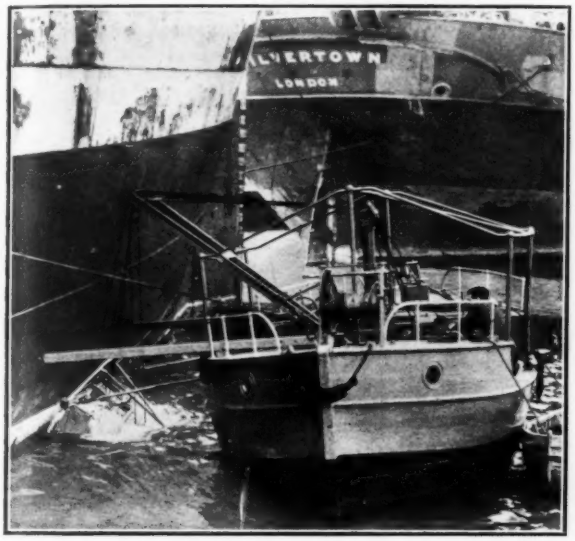
Electrically Scrubbed Ships.

An electrically driven ship cleaner was recently demonstrated at work on the cable-laying steamer *Faraday* in London, England. The equipment and the method of its application are shown in the accompanying cuts.

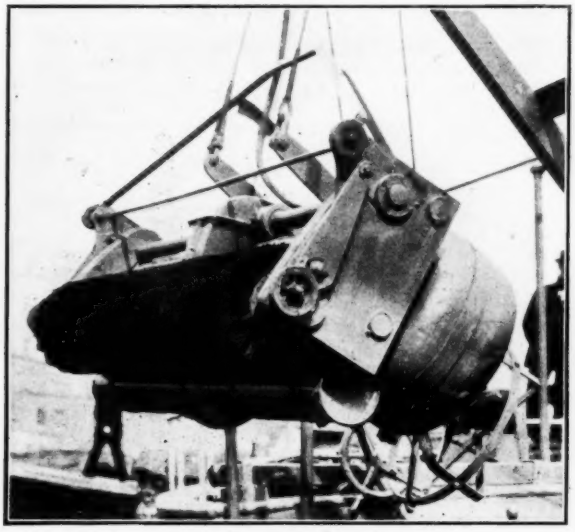
The apparatus consists of a circular coir brush five feet long by 12 inches outside diameter. By the interchange of brushes of different strengths of core the different densities of marine growth can be dealt with. The brush is placed in a frame and driven through inclosed gears by a 15-horsepower electric submersible motor which also operates a bronze screw propeller situated at the rear of the brush. The thrust of the propeller pushes the revolving brush up to its work on the ship's side. The brush makes 250 to 270 revolutions per minute, and the propeller 150 to 170 revolutions per minute. The complete machine is self contained and fitted with adjustable suspension gear and two buoyancy tanks to reduce the weight when the machine is submerged. The brush gear is worked from a double-ended wooden barge 30 feet long by 12 feet beam, fitted with a 28-brake horsepower petrol or paraffin motor driving a 10-kilowatt 230-volt compound-wound interpole dynamo for generating the necessary current. A 15-horsepower motor propels the barge under her own power at a speed of five knots per hour.

An electric winch is fitted amidships complete with derrick and controls for lowering and raising the brushing machine. This winch has four barrels and is driven by a 3.5-horsepower electric motor through a five-speed gear, the motor taking current from the main dynamo. Two of the drums are used for hoisting and lowering ropes, one for the electric cable, and the fourth for raising and lowering the derrick. A gauge registers the depth of the brushing machine. The time estimated for cleaning a vessel like the *Faraday*, which is 360 feet on the water line and of 5,028 gross tons would be about 5.5 hours. After a portion of the *Faraday* had been cleaned the brush was changed for one of softer texture. It is stated that it usually costs from $2,000 to $2,500 to dock a merchant steamer of the size of the *Faraday* for cleaning. With the apparatus described the cleaning operation takes place while the vessel lies in port loading or discharging cargo.

The presence of foreign matter on ships' submerged plating may greatly retard the speed of the ship and thus increase the amount of coal consumption. By easy and frequent application of the electric-motor cleaner, an occasional scrub-down would keep a vessel clean, increase its speed and keep the coal bill down. The demonstration was givn by the Submarine Motor Ship-Cleaner Syndicate, Limited, of 66 Broad Street Avenue, London, England.



Electric Scrubber in Action.



Near View of Scrubber.

Semi-Automatic Switchboard for Newark Telephone Exchange.

The New York Telephone Company has arranged for the installation of a new semi-automatic switchboard at its Market Exchange, Newark, N. J. This board, built by the Western Electric Company at its Hawthorne Works, is said to be the first of its kind to be placed in regular commercial service. The board is constructed to accommodate 7,000 lines, and has 24 positions to be occupied by central operators as against 70 on the regular manual type board. The board can be doubled in capacity by increasing its height. The semi-automatic arrangement employs one set of wires, and necessitates but one movement of the operator when the call is received; this consists of the pushing of a button corresponding to the number desired, which automatically rings the subscriber's bell; the ring continues until answered, and with each ring of the bell a light flashes over the number called, notifying the operator of line conditions. The company is also planning for the installation of a similar board at its Waverly Exchange

General Electric's "Home Electrical" for the Panama-Pacific Exposition.

An attractive feature of the General Electric Company's large exhibit at the Panama-Pacific International Exposition, which will be held in San Francisco next year, will be the "Home Electrical" occupying a conspicuous place in the Manufacturers' Buildings. Besides adopting all the practical ideas previously used in various electrical houses for exhibition purposes, this model home at what will propably be the world's greatest exposition will be the first of its kind to be specially designed and built for the purpose by a skilled architect. It will be an electrical home in every sense of the word, inasmuch as the exhibit will include the electrification of the house, garage, workshop, laundry, creamery, etc. All the practical electrically operated labor-saving devices suitable for use about the home will be shown in actual service.

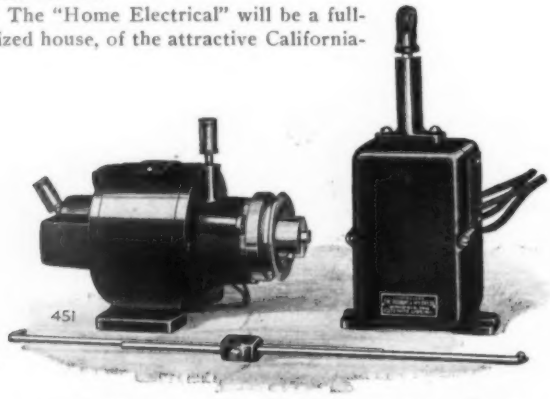
The "Home Electrical" will be a full-sized house, of the attractive California-Spanish type, much the same as the western home of an American family of moderate means. It will consist of a living room, a dining room, breakfast room, bedroom, bath, kitchen, laundry and sewing room. Nearby will be located the electrical garage, the workshop, creamery, etc. The rooms will be suitably decorated and attractively furnished. The plans call for an interior arrangement along the most approved modern lines designed to make housekeeping easy, so that the necessary work can be done without wasted effort or lost time. Each room will be equipped with practical labor-saving and comfort-promoting devices operated by electricity.

The electric wiring of this building will be along the most approved lines and the electric lighting will be entrusted to an illuminating engineer. Mazda lamps will be installed to give an even distribution of light in all parts of the house with no wasted energy, no dazzling flame points, no brilliant glare or heavy shadows.

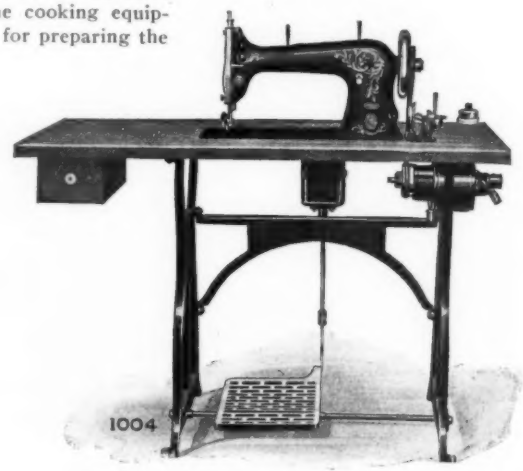
The kitchen, where most of the housework is accomplished, will be provided with an electric range for all cooking purposes, and with electrically driven machines for peeling vegetables, polishing silver, freezing ice-cream, driving cake and dough mixers and doing other necessary work. In the electric laundry the clothes will be washed by electric power and ironed with electric flatirons. In striking contrast the adjoining room will have an electric refrigerating plant of household size where the same form of energy used for heating and cooking will produce low temperatures for preserving foodstuffs and for making artificial ice.

The dining room will be arranged to show how light lunches and suppers can be cooked with the electric chafing dish, or the electric grill, on the table if desired. This same cooking equipment may be utilized for preparing the morning meal in the adjoining breakfast room. The sewing room will be equipped with a motor-driven sewing machine, a small fan and an electric pressing iron suitable for attaching to the light socket. Even the bedroom will have its modern electrical appliances—a small fan, heating pad and baby milk warmer.

In connection with the "Home Electrical," and as a part of the exhibit, will be shown a garage with an electric runabout, battery-charging outfit, etc. Adjoining the garage is to be located a small work shop, completely equipped with electrically driven tools. And, for the benefit of those who live outside the cities and larger towns the use of small motors on the country place will be illustrated by a model dairy room with cream separator, churn, bottle washers, water-pumping station, and other small motor-driven machines, such as are used almost daily on every country place.



Sewing-Machine Motor with Controller and Connecting Rod.



Method of Mounting Outfit on a Sewing Machine.

Robbins & Myers Factory Sewing-Machine Motor.

The sewing-machine motor illustrated herewith is constructed to do heavy work such as is required in tent and awning factories, mattress factories, automobile-top factories, department-store repair shops and in all shops where heavy materials are handled.

This motor is supplied for direct current circuits of 115 or 230 volts and has an output of one-sixth horsepower. The head on the pulley end is solid, completely inclosing the motor at this end. It covers a magnetic clutch brake, the winding of which is in series with the armature winding of the motor. The instant the current is turned on the brake clutch is released, and the instant the current is shut off the brake acts, bringing the motor to an immediate stop. The pulley is an integral part of this brake. It has a pitch diameter of three inches and is suitable for a three-eighths-inch round belt.

The motor is of the series type and is furnished with a special controller, which is connected in series with the armature. The arm of the controller is connected to the pedal of the sewing machine with an adjustable rod. The controller is normally held in the "off" position by a spring, which acts on a plunger connected to the controller arm. By varying the pressure on the treadle the operator shifts the arm from one contact point to another and can get any speed from a few turns per minute up to 3,000 revolutions per minute.

This outfit is manufactured by the Robbins & Myers Company, Springfield, Ohio.

Ohio Breaks Coal Record.

All previous records in the coal production of Ohio were exceeded in 1913 both in quantity and value. The production increased to 36,200,627 tons.

Current Electrical News

NORTH ATLANTIC STATES.

NEWARK, N. J.—The Public Service Electric Company is planning for the erection of a large steam generating station at Point-no-Point on the Passaic River, near Newark. The initial structure will be about 366 by 154 feet, to comprise turbine room, boiler house, and switchboard. Four boilers and two 25,000-kilowatt steam turbogenerators will be included in the initial installation, and provision made for an ultimate capacity of 150,000 kilowatts. A.

RED BANK, N. J.—The Borough Council is considering the establishment of a municipal electric municipal street-lighting system. A.

SOUTH ATLANTIC STATES.

OAKLAND, MD.—The Farmers' Consolidated Telephone Company has been organized here, with a capital stock of $50,000, by R. A. Ravenscroft, A. D. Naynor and others.

MELBOURNE, FLA.—A municipal electric light plant will be established. Address the mayor.

NORTH CENTRAL STATES.

ADA, O.—There is a movement on foot among business men in this city to erect 18 specially designed electric lamp-posts along the Lincoln Highway. These posts will be topped with cluster incandescent lights in red, white and white and blue, carrying out the Lincoln Highway marker idea. The business men's club donated $500 toward this project. H.

CANTON, O.—Plans are in course of preparation for the installation of an ornamental lighting system on some of the downtown streets, and investigations are being made as to the type of light and light standard most suitable for that purpose. Mayor Stolberg can give information regarding the matter. L.

CINCINNATI, O.—The Archiable-Brouse-Parker Company, recently incorporated here with a capitalization of $5,000, by Henry M. Brouse, W. H. Parker, R. J. H. Archiable, William R. Parker and Gerritt J. Fredricks, Jr., will require a good deal of electrical equipment, motors, etc., in a plant which will be fitted up for the manufacture and repair of automobiles, etc. L.

CINCINNATI, O.—The Avondale Home Steam Laundry Company, of this city, has under way plans for the construction of a new plant, for which power will be furnished by an 85-horsepower engine and a 50-kilowatt generator, both of which have been secured. Several motors, which will be used in the operation of machinery, will be required. G. V. Wert is president. L.

CINCINNATI, O.—Property owners on Main Street are behind an effort which is being made to have an ornamental lighting system installed on that thoroughfare. The Main Street Merchants' Association is in touch with the project. L.

CINCINNATI, O.—Plans for a large steam bakery of modern type are being completed by Harry A. Crosby, architect, of this city, to cost $40,000, exclusive of land and equipment. Power and transmission equipment, as well as electric motors for the operation of the machinery, will be required. L.

CINCINNATI, O.—The Ohio Electrolytic Oxygen Company, recently incorporated with a capital stock of $200,000, will build a plant for the manufacture of oxygen and hydrogen by an electrolytic process which will involve the use of considerable electrical equipment. B. L. Heidingsfeld, J. B. Ratterman and others in Cincinnati are interested in the company. L.

CINCINNATI, O.—Electric elevators, wiring and other equipment for lighting, and a series of stations for the use of night watchmen in recording their rounds will be among the equipment which will be installed in the new courthouse to be constructed here. The Courthouse Building Commission has charge of the work. Bids will be advertised for on July 15. L.

CLEVELAND, O.—A number of motors for use in the operation of laundry machinery will be required by the United Electric Laundries Company, recently incorporated with a capitalization of $10,000. F. Carl Raymond, C. N. Fiscus and W. I. Lewis, of Cleveland, are among those interested. L.

COLUMBUS, O.—The Dunlap Electric Truck Company will probably require considerable electrical equipment in a plant which it will erect for the manufacture of electric motor trucks and accessories. The company was recently incorporated with a capitalization of $20,000 by T. C. Dunlap, George R. Hedges, Stewart A. Hoover and others. L.

HILLSBORO, O.—The Business Men's Association has appointed a committee to investigate and report upon the project of putting in a modern municipal light and power plant. The report is to be ready at the next meeting of the association. J.

LOGAN, O.—The Ohio Light & Power Company has secured the right of way for a transmission line from this point to Shawnee, O. The old electric light plant will be used as a substation, where the current will be transformed from the transmission voltage to the voltage used for commercial distribution. From Thornport, Perry County, a complete circuit of high-transmission lines will be constructed via Lancaster to Logan, and thence to New Straitsville, New Lexington, Somerset and Shawnee, where the lines intersect with those from Newark. J.

MEDINA, O.—Generating and transmission equipment will be purchased by the Phoenix Electric Company, which will construct an electric plant here to furnish current for commercial and domestic purposes. The capital stock of the company, which was recently incorporated, is $25,000. L.

SANDUNSKY, O.—H. Whitford Jones, of Cleveland, O., has been retained by city officials to assist in working out a street lighting system for Sandusky. H.

SPRINGFIELD, O.—A large factory building, fully equipped for the use of electric power, and containing its own electric power plant, will be constructed by E. L. Shuey, of Dayton, O., under plans now being made by Schenck & Williams, architects, of Dayton, for the use of manufacturer. The estimated cost of the structure, which will contain three or four stories, is $150,000. Freight and passenger elevators, electrically operated, will be among the equipment. L.

STEUBENVILLE, O.—The Council proposes to extend the electric lighting on Market and Fourth Streets. Address the mayor.

LADOGA, IND.—The Ladoga Telephone Company has been incorporated, with a capital stock of $20,000, by S. H. Foster, H. A. Foster and others.

TELL CITY, IND.—$17,000 will be expended improving the electric plant. Address the city clerk.

CHESTNUT, ILL.—The Chestnut Mutual Telephone Company has been incorporated, with a capital stock of $1,950, by Philander Simcoe, Henry A. Richner and others.

HAVANA, ILL.—The Havana Association of Commerce is at work securing subscriptions for the installation of a cluster light system and also is making an effort to secure the location here of a new electric light plant. A proposal made by the Central Illinois Public Service Company recently was rejected. Z.

McCONNELL, ILL.—The McConnell Telephone Exchange Company has been incorporated, with a capital stock of $1,000, by John F. Rackow, J. W. Stamm and others.

GRAND RAPIDS, MICH.—The new Y. M. C. A. building now being erected will be equipped with its own plant for generating light and power. Address the secretary.

WASHBURN, WIS.—The Northwestern Fuel Company will equip its coal docks with electricity. Address John Gibson, secretary.

AURORA, MINN.—$20,000 will be expended improving electric plant. Address the village clerk.

FESSENDEN, N. D.—A company will be established here, with a capital stock of $15,000, by J. Bursma, R. H. Smith and others to establish electric lights.

SIOUX FALLS, S. D.—An ornamental lighting system may be installed. Address Walter C. Leyse, city auditor, for desired information.

WESSINGTON SPRINGS, S. D.—At a mass meeting of the citizens the plan

for the city to purchase the local electric light system was endorsed. Address city clerk.

DELMAR, IOWA.—The voters at a special election granted a 25-year franchise to the Maquoketah Light and Power Company.

ESTHERVILLE, IOWA.—$60,000 will be spent in more lights and water for the city.

LE MARS, IOWA.—Dr. W. M. Richey is at the head of a movement to extend boulevard lights.

MALVERN, IOWA.—The Malvern Light & Power Company is asking for a special election to decide the question of granting the company a franchise to build their line into Silver City.

NASHUA, IOWA.—The new Cedar Valley Power Company, in developing its business and plant, will build a new concrete dam here, which will be somewhat higher than the present one. An electric generator will be installed to help supply the current for the system.

WATERLOO, IOWA.—The Cedar Valley Power Company has been incorporated. A high-tension line will be run to Clarksville, Hampton, Rockwell and Charles City, and extension lines will be built to smaller towns. A new steam plant will be built at Charles City, equipped with steam turbine, and the water plant will also be equipped. H. H. Caughlin is president.

JEFFERSON CITY, MO.—The power plant on the bridge across the Missouri River was damaged to the extent of $5,000 by fire on June 15. The bridge was slightly damaged. M.

PALMYRA, MO.—$30,000 will be expended improving the light and water system. Address the city clerk for information.

SHELDON, MO.—An election will be held at Sheldon on June 30 to ratify or reject a contract with G. B. Beeny, owner of the local electric light plant, for current for the next three years and also to vote on the installation of 28 additional electric street lights. S. F. Hoppenbrock is city clerk. M.

ST. JOSEPH, MO.—The Council is planning ways to enlarge the capacity of street-lighting plant. Address Elliott Marshall, mayor.

ARKANSAS CITY, KAN.—A proposition to issue $28,000 in bonds for a municipal power plant was rejected at a special election on June 11. The proposition will come up again in the near future, however. An issue of $98,000 for water-works improvements carried. A proposition to make a contract with the Arkansas City Light & Power Company for street lighting and water power also carried. M.

BLUE RAPIDS, KANS.—New boilers and other equipment will be installed in the power plant at Blue Rapids by the management. M.

COFFEYVILLE, KANS.—Maple Street, between Seventh and Eighth, is to be included in the White Way at Coffeyville. Bids for the installation of poles will be received in July by the water and light department. M.

LA CROSSE, KANS.—An election on a bond issue of $12,000 for improvements and extensions to the street-lighting system will be held in July, on a date not yet announced. M.

OTTAWA, KANS.—A transmission line will be built between Ottawa and Marais des Cygnes in the near future by the power company at the latter place. The Bushong Electrical Company, of Ottawa, is interested in the work. M.

PITTSBURG, KANS.—Pittsburg is to have a "White Way." The entire business district is included in plans for the establishment of new ornamental standards. M.

POWHATTAN, KANS.—A bond issue of $10,000 for the establishment of a municipal electric light plant carried at a special election held on June 17. Only four votes were cast against the proposition, and work will begin in the immediate future. M.

SOUTH CENTRAL STATES.

DUCKTOWN, TENN.—Electricity to operate the machinery of its 1,000-ton mine here will be generated by a plant whch is being constructed by the Tennessee Copper Company. G.

RUTLEDGE, TENN.—The Rutledge Telephone Company has been incorporated with a capital stock of $2,500 and will construct 75 miles. Dan West is manager.

SEYPPEL, ARK.—The Crittenden Telephone Company has been incorporated with a capital stock of $10,000. W. G. Pritchard is president.

LAWTON, OKLA.—The Comanche Light & Power Company will reconstruct building and plant. John C. Keys is general manager.

NOWATA, OKLA.—The Nowata Electric Light Company, of this city, has been incorporated. The capital stock is $30,000. E. B. Lawson, Frank Hancock and D. B. Howell, all of Nowata, are the incorporators.

POND CREEK, OKLA.—$7,000 in bonds has been voted to improve, extend and further equip the electric light system. Address E. J. Gentry, mayor.

DALLAS, TEX.—The Southwestern General Electric Company of Dallas has increased its capital stock from $350,000 to $600,000. It will make improvements to its property here. D.

DAYTON, TEX.—The Dayton Light & Power Company, which has been organized here with a capital stock of $20,000, will construct an electric light and power plant. A. E. Kerr is interested in the project. D.

HICO, TEX.—The Central Texas Power & Transmission Company has been incorporated with a capital stock of $100,000 by V. P. Weiser, H. G. Gleason and others.

NEWSOME, TEX.—F. M. Streetman is interested in a proposition to establish an electric light plant.

ORANGE, TEX.—Smythe & McKee were given a franchise to operate a street railway system on June 17. G. M. Hedges and other capitalists also are interested. Work must begin within eight months and the road must be in operation inside of thirty months, according to the franchise. M.

TAFT, TEX.—The electric light plant of the Taft Gin & Oil Company, which was recently destroyed by fire, will be rebuilt. D.

WESTERN STATES.

BUTTE, MONT.—R. F. Morris, general manager, and Attorney Milton Gunn, of the Mountain States Telephone & Telegraph Company, recently submitted plans to the city for an underground system of telephone and telegraph wires in the business section, also in the greater portion of the residence district of this city, to cost approximately $500,000. Plans have been approved of by Mayor Duncan, City Engineer Flood, and City Attorney Mackel. As soon as the City Council approves of the plans, work will be started. It is expected that it will take from one to two years to complete the task. The plans further contemplate the immediate wiring of the portions of the city where improvement districts will be created in the future. O.

CHOTEAU, MONT.—The Choteau Light & Power Company will make extensive improvements during the summer and fall. A new gencrator and other machinery for the power house are numbered among the improvements. O.

LIVINGSTON, MONT.—Charles Garnier, Sr., L. R. Nye and Dan Miles are circulating petitions for ornamental street lights.

VICTOR, IDAHO.—The City Council is considering the installation of a municipal light and power plant, which will supply this city and adjacent territory. O.

OGDEN, UTAH.—Upon the recommendation of the city engineer, the Board of City Commissioners has authorized the extension of the "White Way" to include three more streets in the business district of Ogden. The engineer was ordered to take the matter up with the Utah Light & Power Company, the Ogden Rapid Transit Company and the Webber Club immediately. Lights will be placed on steel poles on both sides of Twenty-fourth Street between Washington and Wall Avenues, and on Grand Avenue between Twenty-fourth and Twenty-fifth Streets. When this work has been completed all streets within the business district will be lighted by the modern system. U.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company are preparing plans and specifications for an addition to their car barns to house the twenty-four new interurban cars which the company have on order and which will be delivered in the course of the next thirty days. The addition will cost $50,000. U.

NOGALES, ARIZ.—The City Council has granted a franchise to Spiro Proto and Monte Mansfield for the construction of an electric light and power plant here. D.

NORTH VANCOUVER, B. C.—The City Council recently passed a resolution requesting the District of North Vancouver to give the necessary year's notice to the British Columbia Electric Railway Company, of its intention to purchase the company's lighting and power franchise, when the same is available in August of 1915. O.

ANACORTES, WASH.—Plans for the installation of a telephone cable between this city and San Juan Islands are being discussed by the Independent Telephone Company. B. T. Conley, district manager of the Independent Company, is authority for the statement that cable will be laid from this city to Lopez on the Islands this summer. O.

CHEHALIS, WASH.—The City Commission is considering the installation of a cluster lighting system on both sides of the streets in the business section. O.

NORTH YAKIMA, WASH.—After repeated delays at the instance of both the city officials and the directors of the Yakima Central Heating Company, it has finally been decided to postpone the matter of putting the proposed electric franchise ordinance of the company before the voters until the county primary election in September. O.

RIDGEFIELD, WASH.—This city recently granted franchises for electric lighting system and a water system, to J. H. Cunningham, of Portland, Ore., and construction on the plants will commence as soon as possible and be rushed to completion. Twelve months are allowed for completion of the water works, and eight months for completion of the electric light plant. O.

ASTORIA, ORE.—The Northwest Electric Company will shortly build a large power plant on the White Salmon River, 12 miles from White Salmon. The company has placed orders for lumber, and the construction of shops, machinery houses, etc., will begin at once. O.

MAPLETON, ORE.—Richard H. Clow, of this city, was recently granted a franchise by the County Court, for the construction and maintenance of a system of electric light and power lines on the streets of this city and on some of the county roads adjacent. The promoter owns a water-power site near here, and will begin work immediately constructing a plant, which will furnish light and power to Mapleton and surrounding territory. O.

NEHALEM, ORE.—An election will be held to decide the question of issuing bonds for the construction of a power plant. Address the city engineer.

TILLAMOOK, ORE.—The City Council, at a recent meeting, granted a light and power franchise to F. D. Small and D. C. Urie, with the understanding that they shall within 18 months expend not less than $30,000 on the project. This proposition has been before the Council for the past six months. O.

CALISTOGA, CAL.—The Calistoga Electric Company has applied to the Railroad Commission for a certificate of public necessity and convenience authorizing it to serve consumers in Napa County north of Bale Station. The territory at present is occupied by the Napa Valley Electric Company.

LOS ANGELES, CAL.—The Midland Counties Public Service Corporation, formerly the Coalinga Water & Electric Company, has asked the Railroad Commission for authority to issue and sell preferred stock in the sum of $650,000. It is intended to devote approximately $410,000 to liquidation of floating indebtedness and to apply the remainder to new construction. Plans for new construction include 20 miles of 10,000-volt transmission line from San Miguel to San Lucas, 35 miles from San Miguel to Jolon, 35 miles from San Luis Obispo to Cambria, 30 miles from San Miguel through Natralla, Chelame and Stone Canyon Valleys, 60 miles from Santa Maria to Lompoc, seven miles from Port San Luis to Avila, together with distributing system, transformers and meters for service in the towns of Morros, Cayucos, Cambria, Bradley, San Ardo, San Lucas, Shandon, Parkfield, Jolon, Banta Ynez, Solvang, Orcuta, Los Olivos and Los Alamos.

PLACERVILLE, CAL.—Plans are under way by the Western States Gas & Electric Company for the expenditure of $50,000 in the enlarging and repairing of its system here.

SACRAMENTO, CAL.—A recommendation has been made to the Board of Control, that the State install in the basement of the Capitol building a light and power plant.

SAN DIEGO, CAL.—The City Council has ordered the installation of ornamental lighting posts on both sides of Fourth Street, between B Street and Broadway.

SANTA ANA, CAL.—The Beaver River Power & Plant Company has been incorporated with a capital stock of $100,000, by H. R. Waldo, G. F. Halliday and others.

TULARE, CAL.—Officials of the Tulare County Power Company have authorized the issue of $1,000,000 in bonds for extensions of the commercial systems. Application for a permit to issue the securities will be made to the Railroad Commission. One of the principal developments will be the construction of a new hydroelectric plant in the foothills east of Porterville, for which plans are now being drawn.

VALLEJO, CAL.—Bids have been called for the installation of 40 electroliers on Virginia Street.

PROPOSALS.

POWER HOUSE.—The Electrical Commission, of Easton, Md., through its president, has called for bids July 8 for a complete electrical plant, which will include engines, generators, switchboards, boilers, stack feed, water heater, piping, pumps, etc. Address T. Hughlett Henry, secretary.

TURBOGENATORS.—On June 30, bids will be received for furnishing one 625-kilowatt-ampere steam turbogenerator to the city of Moorehead, Minn. Plans and specifications may be seen at the office of Edward P. Burch, consulting engineer, 922 Plymouth Building, Minneapolis, Minn. Address R. G. Price, city clerk, Moorehead.

ELECTRIC HOISTS.—On July 2, bids will be received at Room 406 City Hall, Chicago, Ill., for furnishing and delivering to the city three motor-driven hoists for construction plants on the Wilson Avenue tunnel, according to plans and specifications on file in the office of the Department of Public Works. Address L. E. McGann, commissioner of public works.

MOTOR-DRIVEN HOISTS.—Sealed bids will be received at Room 406, City Hall, Chicago, Ill., July 2, for three motor-driven hoists for the construction plants on the Wilson Avenue tunnel, according to plans and specifications on file in the office of the Department of Public Works. Address L. E. McGann, commissioner of public works.

ELECTRIC ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until July 18, for the installation complete of an electric passenger elevator and hydraulic lift in the post office and courthouse at Guthrie, Okla., in accordance with drawing and specification, copy of which may be had at the office of the Supervising Architect.

WIRING.—On July 2 bids will be received for performing the work necessary to install the plumbing, drainage and gas fitting, heating and ventilating apparatus, galvanized-iron work, air washer, electric wiring, conduits, lighting fixtures, lamps and bells, generating set and switchboard, etc., in the new Karnes School, to be erected on Pacific Street, Kansas City, Mo. Address James B. Jackson, Jr., secretary of Board of Directors.

BRIDGE EQUIPMENT.—Sealed bids will be received July 1 at Room 406, City Hall, Chicago, Ill., for furnishing and installing electrical equipment for double-leaf trunnion bascule bridge over the Chicago River at Webster Avenue. This work includes all motors for operating the bridge leaves, center locks and pumps, controllers, lights and fixtures, switches, conduits, wiring, cables, etc., installed complete and ready for operation. Address L. E. McGann, commissioner of public works.

GOVERNMENT BUILDINGS.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until the dates given below for the construction complete, including mechanical equipment, lighting fixtures, etc., of the following buildings: Until July 29, United States post office at Garden City, Kans.; until August 3, United States post office at Three Rivers, Mich.; until August 6, United States post office at Gary, Ind. Drawings and specifications may be obtained from the custodians of the respective sites.

PLANT AND LINE EQUIPMENT.—On July 2, bids will be received for labor and material required in the construction of an electric lighting system for the village of Hills, Minn. The work is divided into four parts. Part 1, a cement block or clay tile building; part 2, furnishing and erecting one 50 horsepower oil engine, necessary piping and accessories; part 3, one 375-kilowatt-ampere, 1,200-revolutions-per-minute three-phase, 60-cycle alternator, with belted exciter, switchboard, etc.; part 4, furnishing and erecting poles, wires, street lamps, transformers, etc., for the electrical distribution system of the village of Hills. Address Otto Nelson, village recorder.

NAVY ELECTRICAL SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for the following material until the dates given. Bidders should get copies of the schedule numbers given from the office mentioned above or the navy pay office nearest each navy yard. Until July 7; schedule No. 6902, 65 kits electricians' tools, a 60-inch motor-driven geared-head engine lathe, a direct-current 220-volt distributing panel; schedule No. 6928, 17,000 feet stranded portable ship-lighting cable, 3,700 feet single rubber-insulated lead-covered wire, 8,000 feet solid rubber-covered lighting and power wire, 51,000 feet duplex rubber-insulated lighting and power wire; schedule No. 6930, miscellaneous double-cotton-covered magnet wire, 8,000 feet plain 30,000-circular-mil twin-conductor wire, ten 30-inch parabolic searchlight-mirrors; schedule No. 6925, 600 bunker lamps; schedule No. 6938, the annual supply of miniature tungsten lamps; schedule No. 6926, 600 pounds electrician's half-and-half string solder; schedule No. 6934, 24 single-phase pole and subway transformers. Until July 14: schedule No. 6896, miscellaneous radio sets, transformers and masts; schedule No. 6913, miscellaneous X-ray apparatus, etc.; schedule No. 6918, 270 telephones.

FINANCIAL NOTES.

Stockholders of the Philadelphia Company at a special meeting voted in favor of reducing the capital stock from $73,400,000 to $69,433,400. The reduction will be made in the five-per-cent shares, according to present plans.

Boston interests have organized the Texas Southern Electrical Company, which has purchased the electric light and power plants at Victoria, Texas, and Cuero, Texas. The company is planning construction of an extensive system of interurban railways, connecting different southern Texas towns.

The Public Service Commisison of the Second District, New York state, has authorized the Federal Telephone & Telegraph Company to issue $500,000 of seven-per-cent cumulative preferred stock at not less than par, the proceeds to be used to liquidate floating debt and for reimbursement of the treasury for capital expenditures from income.

The National City Bank and N. W. Halsey & Company have purchased $12,000,000 five-per-cent first-mortgage bonds of the North Western Elevated, Chicago. This issue is created by a new mortgage, the old first mortgage for $25,000,000 being canceled.

The Maryland Public Service Commission has approved of the modified plan of the United Railways & Electric Company to issue $1,000,000 two-year convertible five-per-cent notes. The new plan differs from the original one only in that it provides that the notes may be converted at par into common stock at the face value of the latter, which is $50 a share instead of thirty-three and one-third dollars. An underwriting syndicate already is being formed to take such portion of the note as may not be subscribed by the stockholders.

The Michigan Railways Company has sold to New York bankers $5,000,000 five-year six-per-cent notes, dated June 1, 1914, and guaranteed by the Commonwealth Railway, Power & Light Company. Notes are part of an authorized issue of $7,000,000. A large amount of the issue has already been sold. Proceeds of the sale will be used to pay for the construction of interurban railway lines between Saginaw and Bay City, and between Grand Rapids and Kalamazoo. Both of these lines are practically finished and ready for operation, the money having been advanced by the Commonwealth company, the holding company, which will now be reimbursed.

Dividends.

	Term	Rate	Payable
Am. Pub. Utils.	Q	0.75%	July 1
Am. Pub. Util., pf.	Q	1.5%	July 1
Am. Tel. & Tel.	Q	2%	July 15
Au'ra. El. & Chi., pf.	Q	1.5%	July 10
Balt. Elec. pf.	Q	2.5%	July 1
Buff. Gen. Elec.	Q	1.5%	June 30
Cen. & So. Am. Tel.	Q	1.5%	July 9
Chi. City & Con. Rys., pf.	S-A	2.25%	July 1
Con. Trac. of N. J.	S-A	2%	July 1
Cum. Co. P. & L. pf.	Q	1.25%	Aug. 1
Detroit Edison	Q	1.75%	July 15
Elec. Stor. Bat.	Q	1%	July 1
Elec. Stor. Bat.	Q	1%	July 1
Elmira W., L. & R. R. 1st pf.	Q	1.75%	July 1
Kan. G. & E. pf.	Q	1.75%	July 1
Mexican Tel.	Q	2.5%	July 16
Nat. Carbon	Q	1.5%	July 1
Nat. G., El. L. & P.	Q	1%	July 1
Nat. G., El. L. & P.	Q	1.5%	July 1
N. E. Tel. & Tel.	Q	1.75%	June 30
P. S. C. of N. J.	Q	1.5%	June 30
Reading Trac.	S-A	0.75%	July 1
Wash., Balti. & Annap. El. Ry., pf.	Q	1.5%	June 30
West India El.	Q	1.25%	July 2
W. Ohio Ry. 1st pf.	Q	1.75%	July 10
W. Ohio Ry., 2d pf.	Q	1.5%	July 20
W. Penn Trac. pf.	Q	1.5%	July 15
Winnipeg El. Co.	Q	3%	

Reports of Earnings.

DAYTON POWER & LIGHT.

	1914	1913
May gross	$ 68,003	$ 58,722
Net before interest	29,483	25,222
Balance after preferred dividend	2,906	644
Five months' gross	389,823	263,932
Net before interest	174,368	111,300
Balance after preferred dividend	43,805	*11,714

*Deficit.

SOUTHERN BELL TELEPHONE.

The Southern Bell Telephone & Telegraph Company has issued a report to the New York Stock Exchange, for the year ended December 31, 1913, wihch compares as follows:

	1913.	1912.
Gross revenue	$7,289,799	$7,454,295
Expenses, taxes, interest and depreciation.	4,884,468	4,750,626
Net earnings	2,405,331	2,703,669
Interest	741,411	638,700
Surplus	1,663,920	2,064,969

TWIN CITY LINES.

	1914.	1913.
April gross	$ 743,578	$ 697,429
Net	357,546	346,770
Surplus after charges	228,398	219,523
Four months' gross	2,920,605	2,733,883
Net	1,317,573	1,287,846
Surplus after charges	801,363	774,367

LEHIGH VALLEY TRANSIT.

	1914.	1913.
April gross	$ 137,274	$ 124,583
Net	67,581	57,523
Surplus	10,675	11,705
Twelve months' gross	1,790,095	1,619,395
Net	897,343	813,358
Balance	264,700	287,452

INTERSTATE ELECTRIC CORPORATION.

Combined earnings of subsidiary companies:

	1914.	1913.
February gross	$ 18,204	$ 16,434
Net earnings	7,949	7,411
Two months' gross	34,858	29,425
Net earnings	14,188	13,257
Twelve months' gross	218,462	194,704
Net earnings	102,974	92,980

MONONGAHELA VALLEY TRACTION.

	1914	1913
April gross	$ 80,616	$ 71,065
Net earnings	48,854	44,864
Surplus after charges	23,319	20,753
Four months gross	306,429	277,446
Net earnings	188,018	179,976
Surplus after charges	86,135	83,555

MEXICAN TELEPHONE.

The Mexican Telephone & Telegraph Company reports for the year ending February 28, 1914, as follows (Mexican currency):

	1914	1913
Gross	$749,290	$716,741
Expenses	376,242	332,132
Net	373,048	384,609
Construction	147,416	616,793

President Smith says, in part: "The company has complied with all its obligations to national, state and municipal governments. Unsettled condition of affairs in Mexico has not seriously affected our business. Collections have been somewhat slower and taxes have been above normal. Owing to the scarcity and high rate of exchange, we have had but a small portion of earnings remitted."

CENTRAL & SOUTH AMERICAN TELEGRAPH.

The Central & South American Telegraph Company reports as follows for the quarter ended June 30, 1914 (receipts partly estimated):

Central & South American Telegraph—	
Traffic receipts	$387,500
Net after taxes	277,500
Other income	3,500
Total income	231,000
Dividend	143,565
Surplus	87,435
Previous surplus	3,385,397
Total surplus	3,472,832

PACIFIC POWER & LIGHT.

	1914	1913
May gross	$ 107,419	$ 104,721
Net after taxes	57,862	44,468
Surplus after charges	26,367	16,291
12 months' gross	1,319,076	1,260,336
Net after taxes	686,358	592,154
Surplus after charges	322,071	287,856
Balance after preferred dividends	77,071	52,856

KANSAS GAS & ELECTRIC.

	1914	1913
May gross	$ 84,417	$ 76,597
Net after taxes	28,889	25,787
Surplus after charges	13,679	11,307
12 months' gross	1,097,279	943,429
Net after taxes	400,844	320,342
Surplus after charges	224,092	154,842
Balance after preferred dividends	119,092	49,842

CITIES SERVICE.

	1914	1913
May gross	$ 281,104	$ 113,621
Net after expenses	272,233	104,112
Balance after interest	243,067	104,112
Balance after preferred dividends	106,234	40,573
Surplus after common dividends	27,722	7,015
Twelve months' gross	3,245,044	1,405,656
Net after expenses	3,151,220	1,334,921
Balance after interest	2,882,324	1,334,921
Balance after preferred dividends	*1,606,789	660,768
Surplus after common dividends	915,506	364,912

Accumulated surplus to May 31, 1914, $2,654,591.

*Equivalent to 11.5 per cent on common stock.

SHAWINIGAN WATER & POWER.

Shawinigan Water & Power Company for May made a new high record in gross earnings, continuing the steady increase which has been a feature for a number of months. Earnings of the company for the first five months of 1914 compare as follows:

	1914	1913
May	$141,965	$133,900
April	141,850	133,785
March	141,815	133,240
February	141,650	132,625
January	141,000	131,200

VIRGINIA RAILWAY & POWER COMPANY.

	1914	1913
May gross	$ 433,497	$ 416,030
Net	221,671	209,047
Surplus after charges	92,430	89,265
11 months' gross	4,717,587	4,443,494
Net	2,373,454	2,224,313
Surplus	971,000	932,894

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	June 22.	June 15
American Tel. & Tel. (New York)	123¾	123¼
Commonwealth Edison (Chicago)	136⅜	136
Edison Electric Illuminating (Boston)	250	250
Electric Storage Battery common (Philadelphia)	51	52
Electric Storage Battery preferred (Philadelphia)	51	52
General Electric (New York)	147⅞	148½
Kings County Electric (New York)	120	120
Massachusetts Electric common (Boston)	11¼	12
Massachusetts Electric preferred (Boston)	60	62
National Carbon common (Chicago)	115	113¾
National Carbon preferred (Chicago)	119½	119
New England Telephone (Boston)	131	131
Philadelphia Electric (Philadelphia)	25¼	25¼
Postal Telegraph and Cables common (New York)	80	80¾
Postal Telegraph and Cables preferred (New York)	67¼	67½
Western Union (New York)	59¼	61⅜
Westinghouse common (New York)	76	76¼
Westinghouse preferred (New York)	124	124

PERSONAL MENTION.

MR. G. M. MILLER, formerly of H. M. Byllesby & Company, has become associated with the firm of A. F. Fitkin & Company, in the capacity of sales manager.

PROF. ALBERT F. GANZ, of Stevens Institute of Technology, is now in Winnipeg, Manitoba, assisting the Public Utilities Commission of that province.

MR. N. P. ZECH has resigned as assistant to the general auditor of H. M. Byllesby & Company, to become treasurer and general auditor of the Atlantic Gas & Electric Company.

MR. GEORGE C. ISBESTER, for the past three years attached to the New York office of the Rail Joint Company, has been given charge of its Chicago office, 215 Railway Exchange Building.

MR. CHARLES C. ADAMS, vice-president of the Postal Telegraph-Cable Company, has been elected president of the Board of Trustees of the village of Lawrence, Long Island, N. Y.

DR. E. RATHENAU, general manager of the Allgemeine Elektricitäts Gesellschaft, Berlin, Germany, has been made an honorary member of the Verband Deutscher Elektrotechniker.

MR. T. P. SHONTS, president of the Interborough Rapid Transit Company, New York City, sailed recently for Europe on the new steamer *Vaterland*. He will be abroad about six weeks.

MR. GERARD SWOPE, vice-president and general sales manager of the Western Electric Company, is making a two months' trip to Europe, in the course of which he will visit the company's various allied interests abroad.

MR. ALFIN BACKLUND, chief electrician of the municipal electric light plant in Kansas City, Kans., was elected president of the Kansas City chapter of the National Association of Stationary Engineers at the annual meeting on June 18.

MR. R. C. CONNLEY, a well known electrical contractor of Sedalia, Mo., was married to Miss Barbara Moore, of Lexington, Mo., at the latter place on June 16. The couple will make their home at Sedalia after an automobile honeymoon through Missouri.

MR. WILLIAM P. BEAR, of Chicago, Ill., has been appointed electrical engineer of the Illinois Public Utilities Commission. Mr. Bear is well known throughout the industry, and was for a number of years connected in a sales and engineering capacity with several of the larger companies.

MR. H. M. BYLLESBY, president, and MR. JOHN J. O'BRIEN, vice-president and general auditor of H. M. Byllesby & Company, are making a tour of inspection of the Pacific Coast public utility properties managed by their firm. MR. OTTO E. OSTHOFF, vice-president and chief engineer, and MR. ELMER DOVER, vice-president in charge of Pacific Coast properties, will join them in the trip.

MESSRS. N. C. KINGSBURY and H. B. THAYER, vic-presidents of the American Telephone & Telegraph Company, are busily engaged with a large staff of toll experts, accountants and others in working out the final details of the proposed contract for toll-line service between the American Telephone & Telegraph system and independent telephone companies in accord with the general offer made by the Bell organization to the attorney-general of the United States last December.

MR. O. B. HENDERSON, sales manager of the pleasure car department of the Baker Motor Vehicle Company, Cleveland, O., has resigned on account of personal interests on the Pacific coast which will demand his constant attention. Mr. Henderson leaves the latter part of the month to take up a permanent residence in Los Angeles. The company announces that many years of faithful and untiring service have been greatly appreciated and Mr. Henderson's departure is greatly regretted.

MR. WILLIAM A. BOLE has been elected vice-president in charge of production and erection, by the board of directors of the Westinghouse Machine Company for the plants at East Pittsburgh and Trafford. Mr. Bole has been in the continuous employ of the company since August, 1882, having successfully filled the positions of general shop foreman, superintendent, manager of works and consulting engineer. He has, therefore, taken part in the growth and development of the company since it employed less than

William A. Bole.

100 men until the present time when the total forces run up into thousands of operatives.

MR. CHARLES E. SCRIBNER, chief engineer of the Western Electric Company, returned early in the month from a two months' visit to Europe. His trip was primarily to appear before a Parliamentary Commission in London to present data regarding the new long-distance high-speed printing telegraph developed under his supervision. The presentation resulted in an order for a trial installation for which the equipment is now in process of manufacture. During his stay in Europe Mr. Scribner also inspected and tested the new duplex cable installed by the German Reichspost between Berlin and Magdeburg.

OBITUARY.

MR. PETER C. DOLAN, formerly general manager of the Pittsfield (Mass.) Street Railway Company, and a pioneer in New England electric railway development, died at Pittsfield on June 12 after an illness of five days. Mr. Dolan and his brother, the late Patrick H. Dolan, were associated in street-railway work from the late seventies until 1909 and were widely recognized in electric-traction circles as exponents of sound policies in the field of construction and operation. The Pittsfield system, which was regarded as a model property for its size, was sold to the Berkshire Street Railway interests in 1908. Since 1909 Mr. Dolan has lived in retirement at Pittsfield. He was 59 years of age and is survived by his widow and four children.

NEW PUBLICATIONS.

PHASE RELATIONS.—An article by A. S. Langsdorf entitled "Phase Relations in Interlinked Polyphase Circuits" has been reprinted from the January issue of *Washington University Studies.*

NEW YORK MERCHANTS' ASSOCIATION—The Yearbook of the Merchants' Association of New York for 1914 is being distributed. It contains 3600 names, and annual reports of the officers and various bureaus.

REPORT OF PUBLIC WORKS IN HOLLAND.—The annual report of the Board of Public Work of the city of Holland, Mich., for the fiscal year ending March 16, 1914, has been issued. This includes the Lighting Department.

FLAME STANDARDS AND PHOTOMETRY.—The Bureau of Standards, Washington, D. C., has issued a circular entitled "Flame Standards in Photometry" which discusses the Hefner, pentane and Carcel lamps as fundamental photometric standards.

EXPORTS AND IMPORTS.—The Bureau of Foreign and Domestic Commerce, Washington, D. C., has issued Bulletin No. 15, entitled "Trade of the United States with the World, 1912-1913." This covers both imports and exports, listed according to countries and articles, and covers two fiscal years.

BOND BETWEEN CONCRETE AND STEEL.—The Engineering Experiment Station of the University of Illinois has issued Bulletin No. 71, entitled "Tests of Bond Between Concrete and Steel," by Duff A. Abrams. This investigates the effect upon bond of surface of bar, shape of section, condition of storage, age, mix, etc.

MEASUREMENT OF HIGH VOLTAGES.—An article from *Washington University Studies* entitled "The Measurement of High Voltages," by William B. Kouwenhoven, has been reprinted in pamphlet form. This is a portion of a thesis presented for the doctor degree at the Karlsruhe Technical High School. The subject is taken up from both the theoretical and experimental sides.

MEASUREMENT OF EARTH'S MAGNETISM.—The article in the March issue of Terrestial Magnetism and *Atmospheric Electricity* entitled "Regarding Improvement of Appliances for Measurement of the Earth's Magnetic Elements by Magnetic and Electric Methods," by L. A. Bauer, has been reprinted. It includes a description of the new laboratory of the Department of Terrestial Magnetism of the Carnegie Institution of Washington.

A. E. R. A. ENGINEERING MANUAL—The American Electric Railway Engineering Association has completed the publication of the A. E. R. A. Engineering Manual, which is a loose-leaf publication nearly two inches in thickness. It consists chiefly of the re-

ports of the Committee on Standards, being the compilation of many years' work in the collection of standards, recommendations, miscellaneous methods and practices that have been adopted or approved by the Engineering Association since its organization. It is planned to augment the volume from year to year by the addition of such new standards or recommendations as are adopted from time to time. The different sections of the volume are illustrated and very completely indexed. Copies of this valuable publication may be obtained by non-members of the Association for $3.00, plus $1.00 for the binder.

NEW INCORPORATIONS.

PORT ARTHUR, TEX.—The Pier Railway Company has been organized here for the purpose of constructing a street-railway system and an interurban line. K. M. Smith, J. W. Williams and C. H. Bosler are incorporators. D.

NEW YORK, N. Y.—Marconi-Telegraph-Cable Company, Incorporated, has been granted articles of incorporation, capitalized at $50,000. The incorporators are Edward J. Nally, of Ossining, N. Y.; John Bottomley, of New York City, and George S. DeSousa, of Brooklyn.

SOUTHOLD, N. Y.—Cutchogue Electric Company, Incorporated, has been granted articles of incorporation to generate electricity, etc. The capital stock of the company is $10,000 and the incorporators are S. N. Moore, O. B. Goldsmith and H. L. Fleet, all of Cutchogue, N. Y.

ROCHESTER, N. Y.—Stromberg-Carlson Telephone Manufacturing Company has been granted a charter to manufacture electrical apparatus, etc. Capital $450,000. Incorporators are Wesley M. Angle, W. Roy McCanne and Fred C. Goodwin, all of Rochester, N. Y. This is a reorganization of this well known manufacturer.

PITTSBURGH, PA.—T. K. H. Sign Manufacturing Company, the object of which is to manufacture electric signs and other signs of all descriptions, has been incorporated in Pittsburgh, under the laws of Pennsylvania, with a capital stock of $5,000. The incorporators are Leon S. Klein, Morton H. Herzog, and Eugene B. Strassburger, all of whom reside in Pittsburgh. S.

DATES AHEAD.

American Society for Testing Materials. Seventeenth annual meeting, Atlantic City, N. J., June 30-July 3. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Electrochemical Society. Twenty-sixth general meeting, Niagara Falls, N. Y., October 1-3. Secretary, Joseph W. Richards, South Bethlehem, Pa.

American Institute of Electrical Engineers. Pacific Coast convention, Spokane, Wash., September 9-11. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York, N. Y.

National Electrical Contractors' Association of the United States. Annual convention, Cadillac Hotel, Detroit, Mich., July 15-18. Secretary, G. H. Duffield, 41 Martin Building, Utica, N. Y.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 21-24. Secretary, D. L. Gaskill, Greenville, O.

Southeastern Section, National Electric Light Association. Annual convention, Isle of Palms, Charleston, S. C., August 19-21. Secretary, A. A. Wilbur, Columbus, Ga.

American Peat Society. Annual meeting, Duluth, Minn., August 20-22. Secretary, Julius Bordello, 17 Battery Place, New York, N. Y.

New England Section of the National Electric Light Association. Sixth annual convention, Narragansett Pier, R. I., September 2-4. Secretary, Miss O. A. Bursiel, 149 Tremont Street, Boston, Mass.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-11. Secretary, S. E. Pohe, Bloomsburg, Pa.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 15-18. Secretary, C. R. George, Houston, Tex.

Electric Vehicle Association of America. Fifth annual convention, Philadelphia, Pa., October 19-21. Secretary, A. J. Marshall, 29 West Thirty-ninth Street, New York, N. Y.

Missouri Electrical Contractors' Association. Annual convention St. Louis, Mo., July 11. Secretary, A. J. Burns, Kansas City, Mo.

With the Electrical Manufacturers

American Electrical Works, Phillipsdale, R. I., has recently issued its June price list covering bare, weatherproof and rubber-covered wires and cables, standard cables, galvanized-iron wire, magnet, annunciator and office wires, and various types of lamp cords.

Terry Steam Turbine Company, Hartford, Conn., announces that it has just finished one of the largest months of its history in points of orders received. In order properly to take care of this business and possible future business, additional machine tools have been installed, increasing the capacity of the plant approximately 25 per cent.

Wagner Electric Manufacturing Company, St. Louis, Mo., has recently issued bulletin No. 105, devoted to central-station transformers. This bulletin gives a complete description of these transformers as well as theoretical data on core loss, copper loss, temperature rise, efficiency, regulation, parallel operation, etc., the latter being of great service and convenience as a general reference. Numerous excellent illustrations are included, and detailed descriptions are given of all parts of the transformers, including outlet bushings, voltage taps, insulation, and cutouts.

The Electric Controller & Manufacturing Company, Cleveland, O., has recently issued a reprint of a very interesting article entitled, "Lifting the One Hundred and Thirty-Million-Pound Quebec Bridge," by H. F. Stratton. This article, which appeared in the December, 1913, issue of the *Engineering Magazine*, describes the construction methods employed in erecting the new Quebec bridge. Many exceeding difficult problems attending erection, required special methods of construction and erection, involving the use of many controllers for huge erecting hoists, towers, etc.

Ward-Leonard Electric Company, Bronxville, N. Y., takes considerable pride in the approval of its Nodaz vehicle-headlight device by the Chicago Board of Motor Vehicle Headlight Inspection. This Board is an offshoot of the Chicago Department of Police, and has been authorized by municipal ordinance to inspect motor-vehicle-headlight equipments and permit the use of those only that meet with approval. This regulation has been developed in accordance with the agitation to minimize the dangers resulting from the excessive glare of automobile headlights.

The Electric Storage Battery Company, Philadelphia, Pa., has received an additional order for 650 sets of Ironclad-Exide batteries for locomotive headlight service from the Southern Pacific Railway Company. With the previous order received several months ago, this makes a total of 946 sets or 2,838 cells of type 13-MV Ironclad-Exide batteries which will be used in this class of service by the Southern Pacific Railway Company. The ruggedness of this type of battery, its long life and the fact that it can be operated for long periods without cleaning, makes this battery well adapted to the severe requirements in this class of railway work.

General Electric Company, Schenectady, N. Y., has recently issued its bulletin, No. 41.302, which covers a complete line of standard polyphase induction motors. The characteristics of the different forms of these motors are analytically described, and the windings used for various classes of service are shown. The illustrations show in detail the construction of the component parts of the motors, and the bulletin also illustrates and describes the various types of compensators and control apparatus required. Several plates of repair parts are given as well as a suitable index to the bulletin. Bulletin No. 48,010, which is another recent publication, is devoted to the use of electricity in the shoe and leather industry. This is a bulletin of 32 pages, which considers, in considerable detail, the subject of electric drive in shoe factories and

tanneries. There are numerous illustrations of installations in various factories of prominence in the East. The bulletin should be of great interest to those connected with this industry. Bulletins Nos. 43,400, 43,401 and 43,402 are devoted to the subject of modern lighting with Mazda lamps in woodworking plants, in the clothing industry and in machine shops and metal working plants respectively. These bulletins describe the various lamps adapted to this service and give suggestions as to the size and style of the units best suited to the greatest all-round efficiency. There are numerous illustrations in each bulletin, which in themselves offer suggestions to those contemplating the installation of a modern lighting system. Another recent publication is bulletin No. 46,201, which illustrates and describes single-phase watt-hour meters, type I-14. These meters are provided with means for obtaining full and light-load adjustment.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports the receipt recently of quite a number of orders for the textile industry. These orders total 217 alternating-current motors, aggregating 4,546 horsepower, and also other equipment as follows: Waltham Bleachery & Dye Works, Waltham, Mass., 13 motors totaling 400 horsepower. Lowell Bleachery, Lowell, Mass., three motors totaling 100 horsepower. River Spinning Company, Woonsocket, R. I., seven motors totaling 230 horsepower, and two 37.5-kilowatt transformers with one three-panel switchboard. City Manufacturing Company, New Bedford, Mass., two motors totaling 75 horsepower. Barre Wool Combing Company, South Barre, Mass., one 100-horsepower motor. Shetucket Company, Norwich, Conn., six motors totaling 105 horsepower. American Mills Company, Waterbury, Conn., 16 one-horsepower loom motors with 16 textile-type switches. American Woolen Company, Fulton, N. Y., three 1,160-kilowatt water-wheel-driven alternators, with three 30-kilowatt exciters and one 75-kilowatt motor-generator exciter set, with a 14-panel switchboard. Clifton Textile Company, Weehawken, N. J., nine motors totaling 95 horsepower. John H. Meyer & Company, Bloomsburg, N. J., one 75-kilowatt turbogenerator unit and exciter with three-panel switchboard, and four motors totaling 35 horsepower. Pine Tree Silk Mills Company, Philadelphia, Pa., 72 one-half-horsepower textile-type loom motors with 72 textile-type switches. J. & J. Dobson, Philadelphia, Pa., one 470-kilowatt low-pressure turbogenerator unit; one Westinghouse Le-Blanc barometric condenser; two motors totaling 500 horsepower; one 25-kilowatt turbine-driven exciter; one 16-kilowatt motor-generator exciter set; one six-panel switchboard. William H. Taylor & Company, Allentown, Pa., seven motors totaling 75 horsepower. Pennsylvania Textile Company, York, Pa., one 562-kilowatts belted alternating-current generator; one 22.5-kilowatt belted exciter; 23 motors totaling 600 horsepower. The Barnesville Manufacturing Company, Fairmont, W. Va., 10 motors totaling 90 horsepower. Norfolk Collar & Pad Company, Norfolk, Va., 11 motors totaling 134 horsepower. Orr Cotton Mills, Anderson, N. C., one 1,000-kilowatt turbo-generator unit; one 10-kilowatt turbo-exciter set; one Westinghouse Le-Blanc condenser; one 12.5 kilowatt motorgenerator exciter set; one four-panel switchboard. Cliffside Mills, Cliffside, N. C., one 375-kilowatt turbogenerator unit with exciter; one 125-kilowatt turbogenerator; one 18-kilowatt generator; two motors totaling 480 horsepower; one four-panel switchboard. Flint Manufacturing Company, Gastonia, N. C., two 200-kilowatt transformers with two-panel switchboard; 14 motors totaling 300 horsepower; 13 oil circuit-breakers. Brown Manufacturing Company, Concord, N. C., 10 motors totaling 290 horsepower; 6 oil circuit-breakers; four auto starters. Aurora Cotton Mills, Burlington, N. C., three 100-kilowatt, 22,000-volt outdoor transformers and one outdoor substation complete; also 11 motors totaling 240 horsepower. Pelzer Manufacturing Company, Pelzer, S. C., two 100-horsepower motors; two 300-kilowatt transformers; one four-panel switchboard. Lang Manufacturing Company, West Point, Ga., 13 motors totaling 275 horsepower; three 100-kilowatt and one 15-kilowatt 11,000-volt transformers, with three-panel switchboard and one set electrolytic lightning arrester. The Westinghouse Electric & Manufacturing Company also reports the following orders received for paper-mill equipments. S. D. Warren & Company, West Brook, Me., five 150-horsepower motors. J. E. Henry & Sons, Lincoln, N. H., one 125-horsepower motor.

Record of Electrical Patents.

Issued by the United States Patent Office, June 16, 1914.

1,099,909. Apparatus for Testing Storage-Battery Circuits. C. E. Beach, assignor to G. O. Knapp, New York, N. Y. A voltmeter-ammeter system with special ground connections.

1,099,912. Telegraph Key. R. C. Brittin, Norwich, Conn. Includes means for locking key.

1,099,914. Advertising Device. J. Buckley, assignor to A. Summer, East Cambridge, Mass. A motor-operated automatom.

1,099,915. Key Plunger Unit. E. B. Craft, assignor to Western Electric Co., New York, N. Y. A plunger switch.

1,099,960. Electric Converter. C. Irving Zimmerman, J. G. Zimmerman, administrator, assignor to General Electric Co. A combination of mercury rectifiers and storage batteries.

1,099,968. Protective Device. E. E. F. Creighton, assignor to General Electric Co. A number of aluminum-cell arresters with special connections.

1,099,986. Outlet or Junction Box. G. A. Lutz, New York, N. Y., and C. C. Sibley, Perth Amboy, N. J. has siding caps over outlet openings. (See cut.)

1,099,987. Outlet or Junction Box. G. A. Lutz, Plainfield, N. J. A modification of 1,099,986.

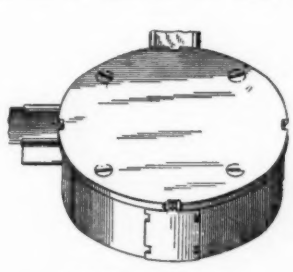
1,099,988. Electric Flat Iron. C. P. Madsen, assignor to The Michigan Stove Co. Covers details of fibrous insulation.

1,099,998. Submarine Signaling Apparatus. J. Schiessler, Baden, near Vienna, Austria-Hungary. A combined wireless-telegraph and submarine signaling system.

1,099,999. Electrical Heater. W. S. Sheppard, Colorado Springs, Colo. A water heater.

1,100,002. Head for Insulating Machines. L. Van Ness, Akron, O. For applying plastic insulation.

1,100,014. Overhead Contact Shoe for Electric Railways. G. Gibbs, New York, N. Y., and E. R. Hill, East Orange, N. J. A pantograph shoe with retractable end portions.



1,099,986 Outlet Box.

1,100,063. Timing Device for X-Ray Tubes and Similar Apparatus. C. F. Fayer, assignor to Wappler Electric Mfg. Co., New York, N. Y. Contact making and breaking device.

1,100,116. Testing System for Telephone Party Lines. C. C. Bradbury, assignor to Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y. Covers details.

1,100,117. Electromagnetic Musical Instrument. G. Breed, Philadelphia, Pa., assignor to Lyrachord Co., New York, N. Y. An electric piano.

1,100,134. Controller. C. A. Jacobson, assignor to Kaestner & Hecht Co., Chicago, Ill. A contactor control panel.

1,100,139. Electric Locomotive with Automatic Cable Reel. W. S. Mayers, Columbus, O., assignor to The Jeffrey Mfg. Co. A motor-operated cable reel.

1,100,140. Automatic Cable Reel. W. S. Mayers, assignor to The Jeffrey Mfg. Co. A modification of 1,100,-139.

1,100,167-8. Telegraph Key. A. H. Adams, assignor to Western Electric Co. Has a number of contacts.

1,100,188. Electromagnetic Device. B. Liebowitz, New York, N. Y. A polarized relay.

1,100,191. Electric Furnace. W. F. McNabb, Pittsburgh, Pa. An electric-arc crucible furnace.

1,100,207. Semaphorical Direction Indicator. G. F. Watts, Brooklyn, N. Y. An electrically operated semaphore.

1,100,225. Electric Testing Apparatus. J. H. Conlon, Union, Ore. A compact battery, resistance and signal-lamp arrangement.

1,100,243. Railway Signal Apparatus. G. Jackson, Jr., Hobokus, N. J. A track-operated signal.

1,100,253. Electric Switch. A. N. Petit, West Orange, N. J. A pull-chain socket with extender.

1,100,257. Automatic Regulator for

Motor Driven Pumping Apparatus. R H. Rice, assignor to General Electric Co. Automatic electrical control of motor-driven pump.

1,100,262. Means for Handling and Distributing Parcels, Bales, Loads and Other Articles. A. G. Seaman, Bowden, England. A remote-controlled electric system.

1,100,268. Interlocking Overhead Trolleys. S. B. Stewart, Jr., Schenectady, N. Y., assignor to General Electric Co. A combination trolley and pantograph.

1,100,280. Method of and Apparatus for Indicating the Speed of Electric Motors. E. F. W. Alexanderson, assignor to General Electric Co. Consists of simultaneously measuring and indicating voltage across armature and field terminals. (See cut.)

1,100,290. Method of and Apparatus for Electrolyzing Liquids. H. H. Dow, assignor to The Dow Chemical Co., Midland, Mich. An electrolytic apparatus.

1,100,294. System for Preventing Shaft Voltages or Bearing Currents in Electric Machines. W. Frick, assignor to General Electric Co. Depends on setting up counter voltage.

1,100,300. Attachment for the Switches of Electric Lamps. A. Herskovitz, Chicago, Ill. A chain attachment for key sockets. (See cut.)

1,100,336. Miner's and Like Electric Safety Lamp. P. Wolf, Zwickau, Germany. An incandescent lamp.

1,100,340. Potential Regulator for Dynamo-electric Machines. V. G. Apple, assignor to The Apple Electric Co., Dayton, O. Means for intermittently interrupting field resistance.

1,100,357. Telegraphic Transmitter. P. D. Delany, South Orange, N. J. An automatic transmitter.

1,100,382. Signaling System. M. Levison, assignor to Chicago Signal Co., Chicago, Ill. A hospital signaling system.

1,100,383. Thermostat. G. W. Lorimer, assignor to W. R. Keve, Piqua, O. An electric thermostat with testing means.

1,100,385. Control System for Automatic Telephone Switches. F. R. McBerty, assignor to Western Electric Co., New York, N. Y. Includes use of driving motor.

1,100,407. Electric Control System. H. A. Steen, assignor to Allis-Chalmers Mfg. Co. A disk contact-making device.

1,100,408. Interbraced Pantograph Trolley. J. A. Townsend, Pasadena, Cal. Pivotal axes in parallel planes, the axes being in angular relation.

1,100,413. Selective Impulse Transmitter. J. A. Wotton, assignor to Western Electric Co., New York, N. Y. A disk impulse transmitter.

1,100,428. Circuit-Controlling Device. C. C. Graves, assignor to Western Electric Co. A vibrator.

1,100,437. Fixture-Supporting Attachment. W. Lutz and A. D. Doe, Chicago, Ill. A metallic bar suspension.

1,100,480. Telephone Equipment. W. M. Harlson and J. F. Pilkington, Dallas, Tex. Includes use of signal lamp with automatic telephone instrument.

1,100,485. Shield for Circuit Closers. J. F. Kelly, Pittsfield, Mass. For electrically operated musical instruments.

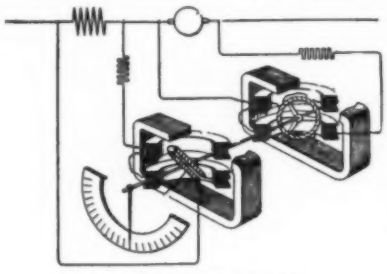
1,100,501. Electromagnetically Controlled Keyboard for Perforating Apparatus. B. Soldatencow, Paris, France. A solenoid-operated device.

1,100,505. Electric Outlet Fitting. G. B. Thomas, assignor to The Bryant Electric Co., Bridgeport, Conn. A concealed-lamp fitting.

1,100,515. Electric Switch. J. M. S. Anderson, assignor to The Perkins Electric Switch Mfg. Co., Bridgeport, Conn. A snap switch with provision to insure operation upon wearing away of parts.

1,100,542. Trolley Guard. R. Dac, Passaic, N. J. Pivoted horns extend beyond trolley wheel.

1,100,556. Electrical Egg Tester. A.



1,100,280.—Speed Indicator.

E. Graves, Lenexa, Kans. An incandescent-lamp tester.

1,100,567. Dynamo-Electrical Machine. W. Horr, Erdington, Birmingham, England. An interpole dynamo.

1,100,584. Means for Regulating Electric Lamp Circuits. H. Leitner, London, England. An automatic rheostat.

1,100,585. Electric Heating Coil. C. C. Lillibridge, Hutchinson, Kans. Covers details.

1,100,633. Alarm Lock. C. C. Tuch, Honolulu, Hawaii. An electric-bell alarm.

1,100,644. Electric Train-Control System. A. J. Allard, Richmond, Va., assignor of one-third to T. F. Green

1,100,300.—Key Attachment.

and one-third to D. R. Creecy, Jr. A solenoid-control system.

1,100,648. Electric Agitator. H. F. Bennett, Chicago, Ill. Covers details of soda-fountain agitator.

1,100,650. Spark-Plug. W. M. T. Besson, Selma, Ala., assignor of one-half to H. A. Vaughan. Covers details.

1,100,651. Alternating-Current Magneto for Ignition and Combustion Engines. G. A. Briggs, Elkhart, Ind. An ignition generator and circuit-breaker.

1,100,680. Socket or Base of Trolley Poles for Electric Traction Systems. E. M. Munro, London, England, assignor of one-half to The R. E. T. Construction Co. Covers details.

1,100,681. Electric Lock and Alarm Apparatus. O. Nitsch, Harburg-on-the-Elbe, Germany. A door lock and bell alarm.

Reissue, 13,748. Original, 1,029,980. Insulator. J. Ellis, St. James, Mo. Covers details of shape.

Reissue, 13,750. Original, 1,016,268. Circuit-Controlling Device. W. B. Hughes, assignor to Elevator Supply & Repair Co., Chicago, Ill. An automatic circuit closer.

Reissue, 13,753. Original, 1,056,921. System of Control for Dynamo-Electric Machines. J. N. Mahoney, assignor to Westinghouse Electric Mfg. Co. A liquid-rheostat control.

Patents Expired.

The following United States electrical patents expired June 22, 1914:

584,785. Electric Gas-Lignting and Extinguishing Apparatus. G. F. Krieger, Kiel, Germany.

584,798. Burglar Alarm. H. M. Sutton and W. L. Steele, Dallas, Tex.

584,810. Telephone Transmitter. R. S. Barnum, Chicago, Ill.

584,819. Telephone Annunciator, Call Bell and Fire Alarm. M. Garl, Akron, Ohio.

584,823. Combined Bracket and Insulator. G. W. Mead, Shellsford, Tenn.

584,843. Automatic Switch for Electric Circuits. R. Belfield, London, England.

584,848. Electromagnet. C. F. Bostian, Milton, Pa.

584,853. Therapeutic Electric-Current Generator. E. W. Chellis, Erie, Pa.

584,856. Controller for Electric Motors. H. P. Davis, Pittsburgh, Pa.

584,867. Arc-Lamp Carbon. T. M. Foote, Chicago, Ill.

584,868. Telephone. J. T. Gent, A. W. Staveley and I. H. Parsons, Leicester, England

584,871. Telephone Bracket. A. Y. Gordon, Massillon, O.

584,873. Electric Railway. F. W. Hunter, Cranford, N. J.

584,879. Coin-Freed Electric Meter. G. Knight and G. Ellis, Southsea, England.

584,911. Electric-Railway System. G. Westinghouse, Jr., Pittsburgh, Pa.

584,912. Brush Holder for Dynamos. J. H. Yearsley, Philadelphia, Pa.

584,918. Electric-Railway Trolley. E. M. Bentley, New York, N. Y.

584,936. Electric Conductor. I. W. Henry, New York, N. Y.

584,957. Electrotherapeutical Apparatus. F. J. Patten, New York, N. Y.

584,983. Electric Arc Lamp. A. Bureau, Brussels, Belgium.

585,018. Mining Machine. H. H. Bliss, Washington, D. C.

585,019. Apparatus for Electric Thermal Treatment of Metals, Ores, Etc. G. D. Burton, Boston, Mass.

585,030. Magnetic Circuit-Breaker. W. E. Harrington, Philadelphia, Pa.

585,026. Tieless Insulator. R. Delery, New Orleans, La.

585,040. Method of Melting Iron by Means of Electricity. C. G. P. De Laval, Stockholm, Sweden.

585,047. Conductor for Underground Electric Railways. C. Petersen, San Francisco, Cal.

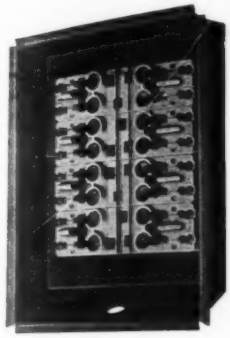
585,072. Auxiliary Fire-Alarm System. R. E. Alexander, Yonkers, N. Y.

585,137. Multiple-Filament-Regulating Incandescent Lamp. C. Truitt, Columbia, Mo.

585,138. Electrical Alarm for Door Locks. P. V. Vandervelde, Corona, N. Y.

585,160. Method of and Machine for Electric Welding. R. D. Eyre, Johnstown, Pa.

Reissue. 11,613. Insulated Support for Contact Rails. A. Hanson and J. R. Chapman, Chicago, Ill.



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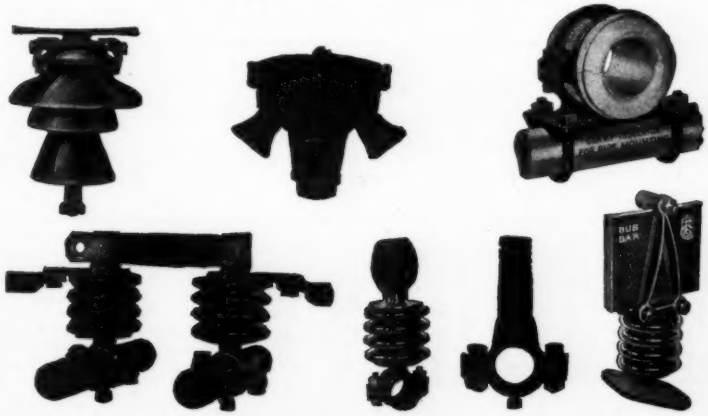

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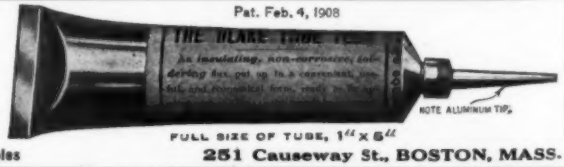

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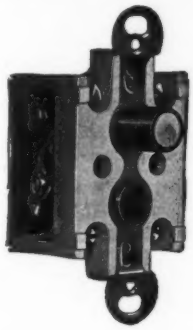

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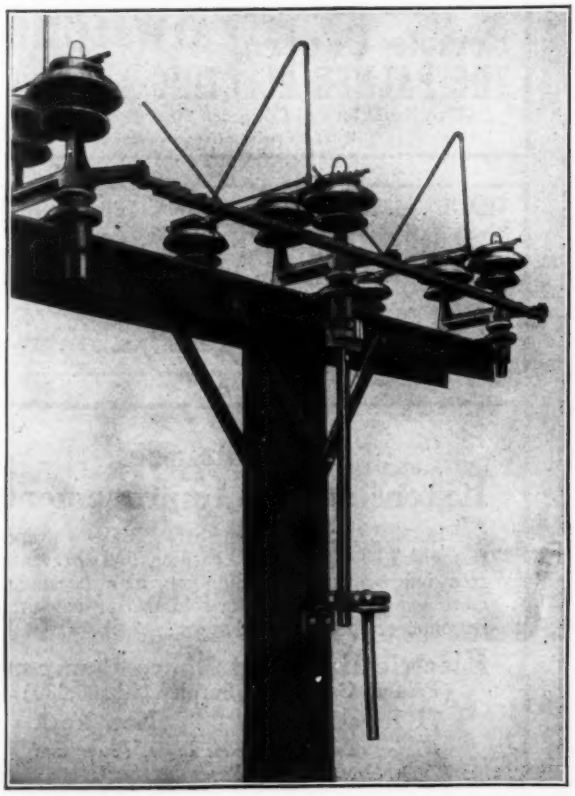

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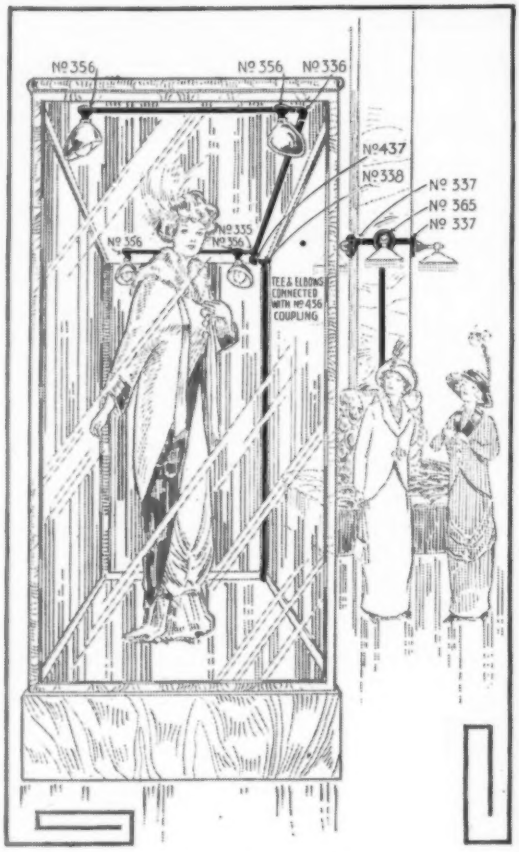

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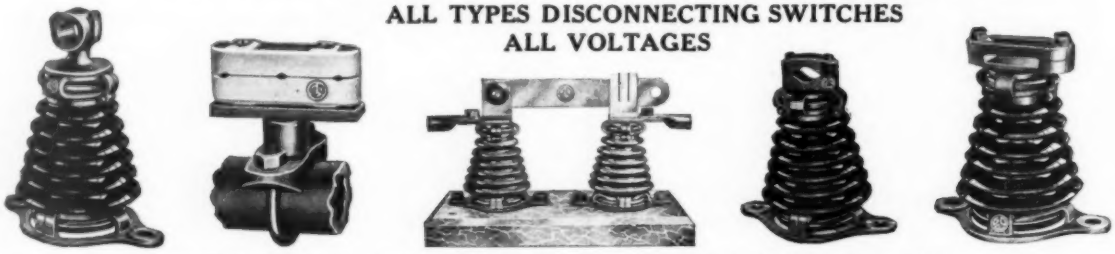

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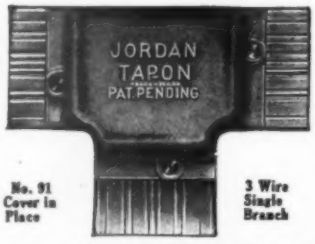

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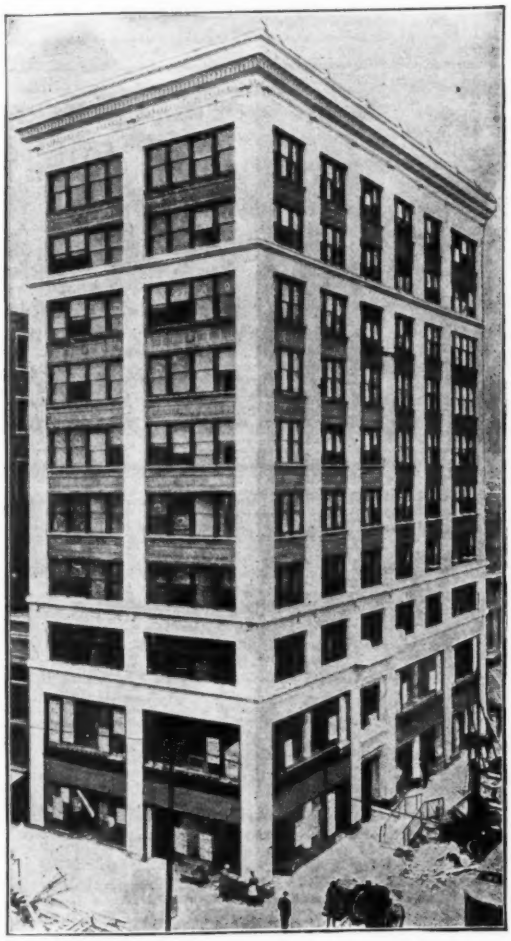

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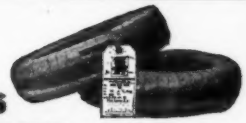

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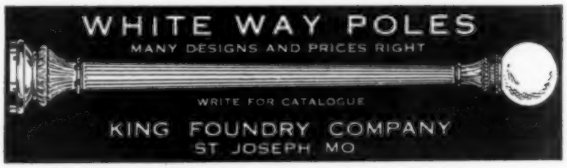

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WESTINGHOUSE guarantees your lamp

600 C.P. 20 Amp. Westinghouse Mazda Lamp

2000 Improved Westinghouse Mazda Lamps to Light Streets of Chicago

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After careful consideration of all the various makes of lamps and reflectors, the Board of Trustees of the Sanitary District of Chicago, has awarded to the Westinghouse Lamp Company, a contract for a minimum quantity of 2,000 and a maximum quantity of 10,000 lamps with suitable fixtures.

The lamps will be 600 candle power, 20 ampere, ½ watt per candle, Improved Westinghouse Mazda Street Series, and the fixtures will be Westinghouse Luxsolite copper cased with white porcelain surfaced reflectors fitted with a compensator for operating on a 6.6 or 10. ampere primary delivering 20 amperes to the lamp.

It is significant that the second city in the United States should so quickly decide to use the improved street series Mazda lamps and then specify *Westinghouse* Lamps and *Westinghouse* fixtures.

It is another example of the confidence that discriminating purchasers have in electrical goods labeled "Westinghouse."

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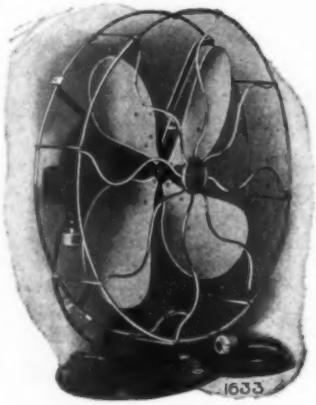

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Their reputation upholds your prestige as a merchant who handles the highest grade of electrical goods. This is a pretty good combination to tie to. It's not too late to take advantage of it **now.** A request for information will receive prompt and courteous attention.

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We are also the largest exclusive manufacturers of small motors, 1-60 to 15 h.p., D.C., and 1-60 to 1 h.p., A.C.

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Merchants in *Things Electrical* are finding Catalog S-3 a real business-getter—the best seller of the season.

It illustrates an attractive line of moderate priced chandeliers that appeals to the average home-owner. And the *24-hour shipment service* back of it is a maker of satisfied customers.

For a larger, and more profitable chandelier business you should have a copy of this new Beardslee Catalog.

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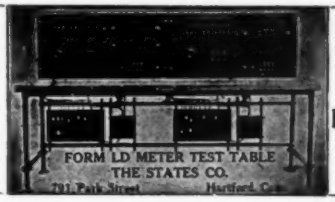

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is infinitely better in an A. C. watthour meter than two or more smaller magnets whose combined weight is the same. In the case of one magnet you have one air gap only, whereas, in two magnets the air gap is doubled, and added air gaps destroy the permanency. It is a fact, too, that if you make a magnet of a certain weight, with one air gap, it will give certain definite and permanent results. If you take the same amount of steel and make two magnets it will be found that the life and permanency of these two magnets will be only ¼ that of the single magnet. Further, if from this amount of steel, four magnets are made, the life and permanency of these magnets will be only 1/16 that of the single or larger magnet, thereby proving that an A. C. watthour meter with more than one magnet in it cannot be depended upon for longevity of service.

All Duncan A. C. watthour meters are provided with one large artificially aged permanent magnet, whose longevity is guaranteed to be greater than that of any other meter on the market.

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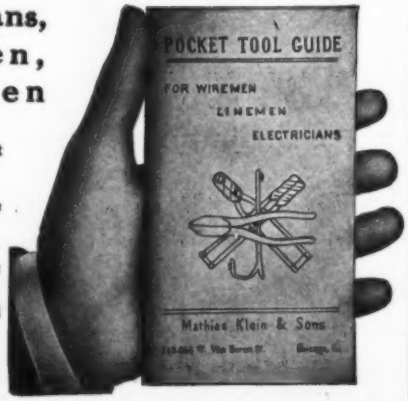

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"Novalux" is the new name given to all G-E pendent and ornamental units wherein the new sizes of series MAZDA Lamps are used.

Maximum efficiency of these new high candle-power lamps is obtained at high current values. To get this high current for efficient street lighting the Novalux compensator unit has been especially designed.

It contains an individual compensator for correct operation of the 20 ampere lamps on 6.6 and 7.5 circuits—saving about 25% of the energy required for straight series.

In addition to the excellent efficiency obtained, the design of the compensator is such that regulation is very appreciably improved.

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NOVALUX

General Electric Company

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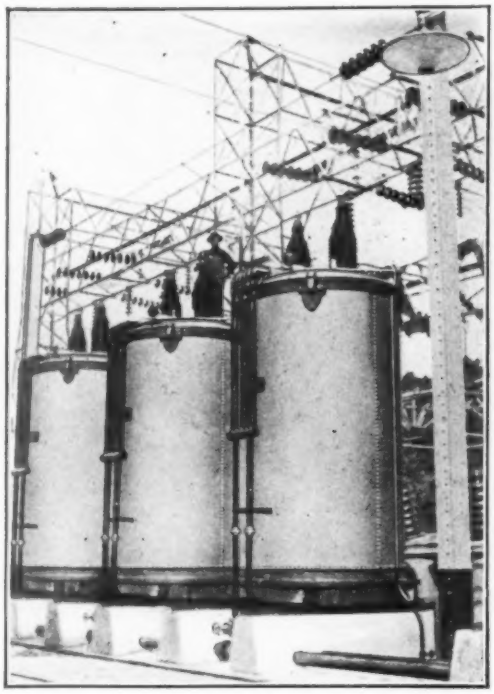
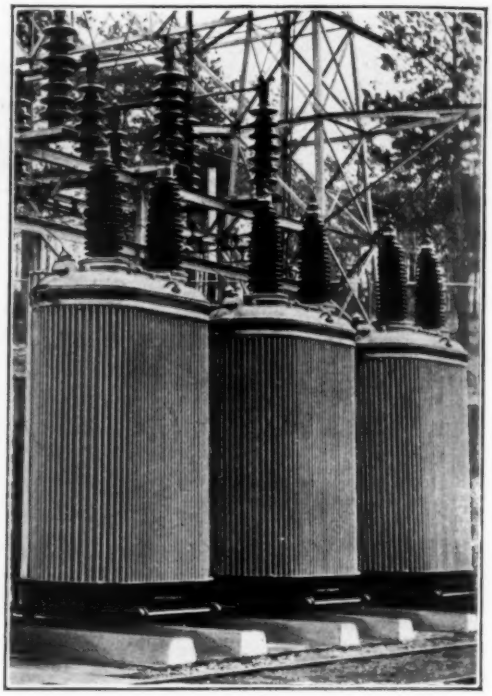


110,000-volt, 3333-kv-a. water-cooled transformers at Boulevard Substation, Atlanta.



110,000-volt, 500-kv-a. self-cooled transformers. Installed at Gainesville Substation.

High Voltage Outdoor Transformers Self-Cooled and Water-Cooled

The illustrations show two typical installations of G-E Transformers for outdoor service. Both installations are part of the Tallulah Falls development of the Georgia Railway and Power Company.

The water-cooled transformers shown are part of the equipment of the largest outdoor substation in the world.

This system has been in operation for several months with a remarkably good record for continuous service, and proves the success of both self-cooled and water-cooled G-E Transformers in outdoor service.

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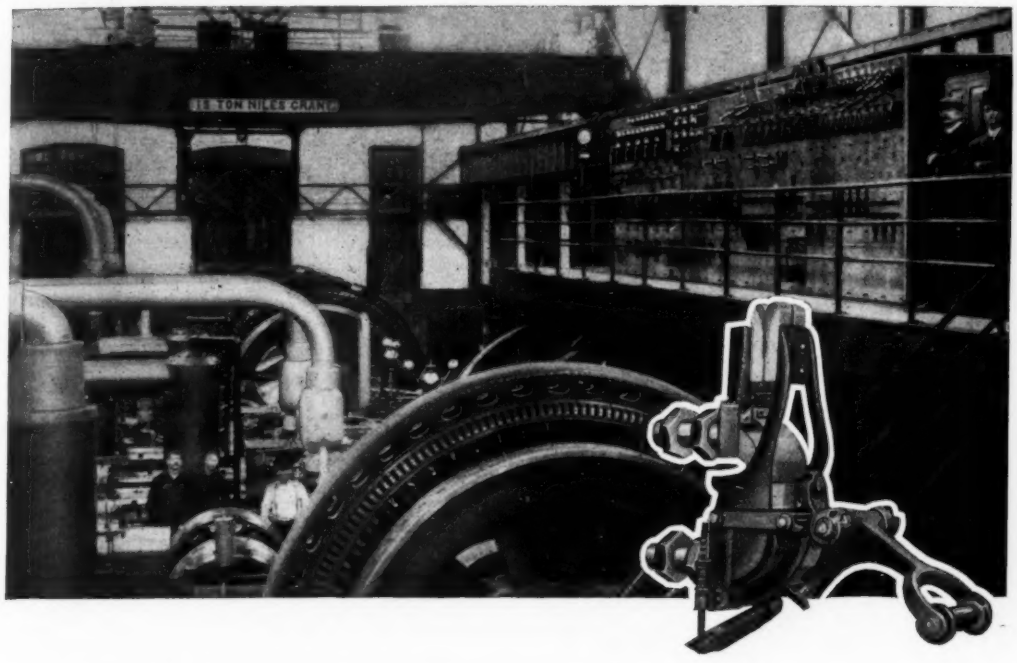

G-E Circuit Breakers in a Big Railroad Shop

The illustration shows a number of G-E Circuit Breakers installed in the West Albany Shop of the New York Central Railroad.

This is one of the largest shops on the New York Central Lines.

In details of construction G-E Circuit Breakers have many points of superiority over any other circuit breakers made, and every G-E Circuit Breaker has behind it the reputation of the Largest Electrical Manufacturer in the World.

Write our nearest office for detailed information regarding any or all types of G-E Circuit Breakers.

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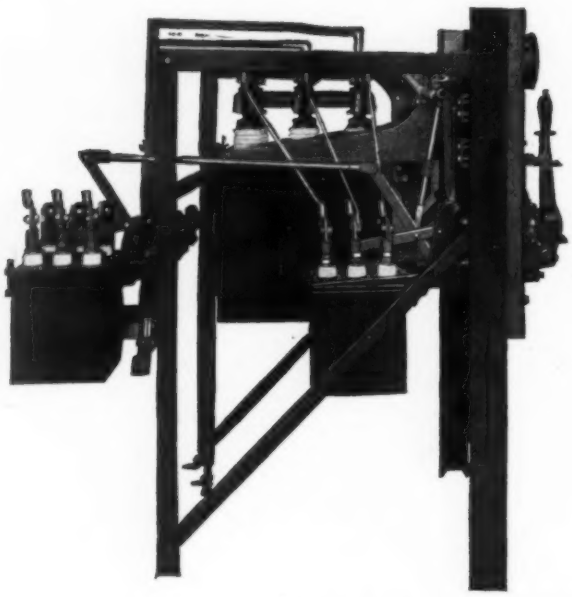

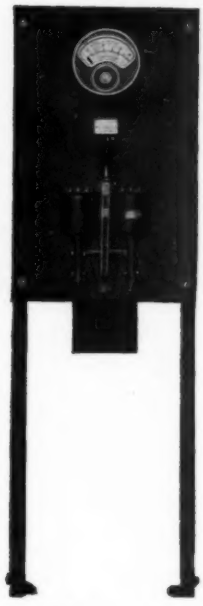

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for Controlling and Protecting Three-Phase Induction Motors.

One of the most popular lines of G-E "Standard Unit" Panels is a line of induction motor panels. These panels are suitable for installation near the motors. Where necessary, interlocks are provided to prevent switches being operated in incorrect sequence. Panels are furnished with or without ammeter and low voltage release, as desired.

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Other panels are listed for external resistance motors and for squirrel cage motors up to 4000 horsepower, but for the first case, controllers, and for the second case, starting compensators or auto-transformers must be added to the regular panel equipment.

Our Bulletin A4178 describing all these panels will be sent on request.

Select your Switchboard Panels from a G-E Bulletin

General Electric Company

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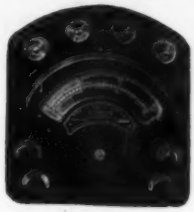
Miniature Precision Instruments for Direct Current



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A new group of very small Indicating Instruments.

COMPACT—ACCURATE—DURABLE—BEAUTIFUL

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This group also includes BATTERY TESTERS.

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Voltmeters Volt-Ammeters Ammeters Mil-Ammeters

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They embody characteristics which have made the well known Weston Standards famous throughout the world.
They are accurate, dead beat and extremely sensitive.
They may be left continuously in circuit at full load without injury and are shielded against the external electrical and magnetic influences of other apparatus in their vicinity.
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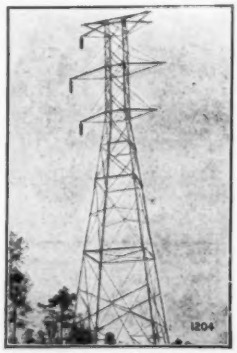

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A Complete List of the Manufacturers of Electrical Material, Under Proper Classification, Is Published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN in the First Issue of Each Month.

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The rate for "Positions Wanted" advertisements is two cents per word, minimum charge 50 cents an insertion, payable in advance. Remittances and copy should reach this office not later than Monday 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 608 So. Dearborn Street, Chicago, or 13-21 Park Row, New York.

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WANTED — Foreman to take charge ot high tension ignition coil work—must be thorough and experienced —steady employment for right man. Remy Electric Company, Anderson, Ind.

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1	1	Wagner, Model SXSA, 110 or 220V	1750	
1	1	Wagner, type XS, 110 or 220V	1750	
1	1	Century, auto., 110 or 220V	1750	
1	1	Wagner, type TB, 110 or 220V	1165	
1	2	Gen. Elec., type KS, form CG, 110 or 220V	1800	
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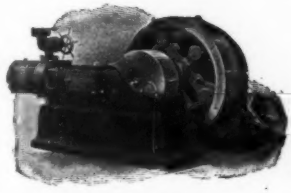

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Westinghouse Electric & Mfg. Co.

BRACES, Cross Arm.
Bissell Co., F.
Hubbard & Co.

BRACKETS, ARMS AND PINS. (Iron).
Anderson Mfg. Co., Albert & J. M.
Brady Electric Mfg. Co.
Cutter Co., George.
Delta-Star Electric Co.
Electrical Engineers' Equipment Co.
Faries Mfg. Co.
General Devices & Fittings Co.
Hubbard & Co.
Ohio Brass Co.

BRACKETS, Pothead.
Bissell Co., F.
Electrical Engineers' Equipment Co.
General Devices & Fittings Co.

BRAKES, Dynamo.
Cutler-Hammer Mfg. Co.
Independent Electric Mfg. Co.

BRAKES, Electric.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Sundh Electric Co.
Western Electric Co.

BRAKES, Motor.
Electric Controller & Mfg. Co.
Westinghouse Electric & Mfg. Co.

BRASS AND COPPER.
Bridgeport Brass Co.

BRIDGES.
American Bridge Co.

BRIDGES, RAILROAD AND HIGHWAY.
American Bridge Co.

BRIDGES AND TOWERS, COAL HANDLING.
American Bridge Co.

BRUSHES, Carbon and Graphite.
Central Electric Co.
Dixon Crucible Co., Joseph.
General Electric Co.
Holmes Fibre Graphite Mfg. Co.
Le Valley-Vitae Carbon Brush Co.
Morgan Crucible Co., Ltd.
National Carbon Co.
Nungesser Carbon & Battery Co.
Reisinger, Hugo.
Speer Carbon Co.
Triumph Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

BRUSHES, Metallic.
Cutler-Hammer Mfg. Co.
General Electric Co.
Speer Carbon Co.
Triumph Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

BUFFERS, Motor Driven.
Hamilton-Beach Mfg. Co.

BUILDINGS, OFFICE AND MILL.
American Bridge Co.

BUNKERS AND HOPPERS.
American Bridge Co.

BURGLAR ALARMS.
Manhattan Electrical Supply Co.
Ostrander & Co., W. R.
Stanley & Patterson.

BUS BAR SUPPORTS.
Delta-Star Electric Co.
Electrical Engineers' Equipment Co.
General Devices & Fittings Co.

BUSHINGS AND LOCKNUTS. (For Conduit.)
Anderson Mfg. Co., Albert & J. M.
Faries Mfg. Co.
Federal Sign System (Electric).
General Electric Co.
Sprague Electric Works.
Thomas & Betts Co.

BUSHINGS, Porcelain Clamping.
Federal Sign System (Electric).
General Electric Co.
Multi Refillable Fuse Co.
Pass & Seymour, Inc.

BUSHINGS, Socket.
Hemming Mfg. Co.
Western Electric Co.

CABLES.
American Electrical Works.
American Steel & Wire Co.
American Insulated Wire & Cable Co.
Atlantic Insulated Wire & Cable Co.
Belden Mfg. Co.
Brixey, W. R.
Central Electric Co.
Electric Cable Co.
General Electric Co.
Habirshaw Wire Co.
Hazard Mfg. Co.
Kerite Insulated Wire & Cable Co.
Moore, Alfred F.
National Conduit & Cable Co.
Okonite Co.
Packard Electric Co.
Roebling's Sons Co., John A.
Safety Insulated Wire & Cable Co.
Simplex Wire & Cable Co.
Standard Underground Cable Co.
Western Electric Co.

CABLE BELLS.
Electrical Engineers' Equipment Co.
General Devices & Fittings Co.

CABLE GRIPS.
Universal Cable Grip Co.

CABLE HANGERS.
Anderson Mfg. Co., Albert & J. M.
Bissell Co., F.
Hubbard & Co.
Standard Underground Cable Co.
Western Electric Co.

CABLE RACKS.
Electrical Engineers Equipment Co.
General Devices & Fittings Co.
General Electric Co.
Standard Underground Cable Co.
Universal Cable Grip Co.

CABLE TERMINALS.
Standard Underground Cable Co.

CABLE TESTERS.
Standard Underground Cable Co.

CABLES, Armored. (Flexible.)
Sprague Electric Works.
Standard Underground Cable Co.
Western Conduit Co.

CABLING MACHINES.
New England Butt Co.

CALIBRATORS, Meter.
Fort Wayne Electric Works.
General Electric Co.

CANOPY INSULATORS.
Faries Mfg. Co.
General Electric Co.
Mica Insulator Co.

CARBONS, Arc Light.
Central Electric Co.
Frorup & Co., L. E.
General Electric Co.
Koerting & Mathiesen.
National Carbon Co.
Reisinger, Hugo.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CARBONS, Battery.
Manhattan Electrical Supply Co.
National Carbon Co.

CAR HEATING, Electric.
Johns-Manville Co., H. W.
Simplex Electric Heating Co.
Western Electric Co.

CAR LIGHTING SYSTEMS.
Gould Storage Battery Co.
United States Light & Heating Co.

CARS, DERRICK.
American Bridge Co.

CASTINGS.
Anderson Mfg. Co., Albert & J. M.
Faries Mfg. Co.
New England Butt Co.
Triumph Electric Co.

CEMENT MACHINERY.
Allis - Chalmers Manufacturing Co.

CHAINS, Power Transmission.
Morse Chain Co.

CHAINS, "Rocker-Joint" Transmission.
Morse Chain Co.

CHANDELIERS.
Beardslee Chandelier Mfg. Co
Central Electric Co.
Faries Mfg. Co.

CHANGERS, Inc. Lamp.
McGill Mfg. Co.

CHARGING OUTFITS.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wagner Elec. Mfg. Co.

CHOKE COILS.
Anderson Mfg. Co., Albert & J. M.
Delta-Star Electric Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

CIGAR LIGHTERS.
General Electric Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CIRCUIT BREAKERS, Automatic.
Cutler-Hammer Mfg. Co.
Cutter Co.
Fort Wayne Electric Works.
General Electric Co.
Independent Electric Mfg. Co.
Sundh Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CLAMPS, Cable Supporting.
Delta-Star Electric Co.
Electrical Engineers' Equipment Co.
General Devices & Fittings Co.

CLAMPS, FLEXIBLE TUBING.
T. W. Manufacturing Co.
Delta-Star Electric Co.

CLAMPS, Insulator.
Electrical Engineers' Epuipment Co.
General Devices & Fittings Co.

CLEATS, Fibre.
Blake Signal & Mfg. Co.
General Electric Co.

CLEATS, Insulating.
Hemming Mfg. Co.

CLIMBERS, Linemen's.
Cincinnati Tool Co.
Klein & Sons, Mathias.
Oshkosh Mfg. Co.
Western Electric Co.

CLOTH, Insulating.
Mica Insulator Co.
Packard Electric Co.

CLUSTERS.
Benjamin Electric Mfg. Co.
Central Electric Co.

CLASSIFIED INDEX—Continued

Delta-Star Electric Co.
Faries Mfg. Co.
Federal Sign System (Electric).
McGill Mfg. Co.
Western Electric Co.

COAL MINING MACHINERY.
Allis - Chalmers Manufacturing Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

COILS.
American Electrical Works.
Belden Mfg. Co.
D & W Fuse Co.
General Electric Co.
Independent Lamp & Wire Co.
Manhattan Electrical Supply Co
Ostrander & Co., W. R.
Stanley & Patterson.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

COMMUTATOR LUBRICANTS.
Dixon Crucible Co., Joseph.
McGill Mfg. Co.
McLennan & Co., K.

COMMUTATOR TRUING DEVICES.
Jordan Bros., Inc.

COMPOUNDS, Boiler Cleansing.
Dearborn Chemical Co.
Johns-Manville Co., H. W.

CONDENSERS, Electric.
Leeds & Northrup Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CONDENSERS, Steam.
Allis - Chalmers Manufacturing Co.
Westinghouse Machine Co.

CONDUIT RODS.
Bissell Co., F.
Standard Underground Cable Co.
Western Electric Co.

CONDUIT, Underground. Clay, Composition, Pipe, Wood.
American Conduit Co.
American Conduit Mfg. Co.
Camp Co., H. B.
Central Electric Co.
Clifton Mfg. Co.
Johns-Manville Co., H. W.
McRoy Clay Works.
Sprague Electric Works.
Tubular Woven Fabric Co.
Western Conduit Co.

CONDUIT ENGINEERS & CONTRACTORS.
Gest, G. M.
Graner-Mahoney Contracting Co.
Standard Underground Cable Co.
Turner Improvement Co., J. W.
Westinghouse Electric & Mfg. Co.

CONDUIT THREADERS.
Delta-Star Electric Co.

CONNECTORS.
Delta-Star Electric Co.
Dossert & Co.
Electrical Engineers Equipment Co.
General Devices & Fittings Co.
Meliorate Mfg. Co.

CONSTRUCTION, Engineering.
Arnold Co.
Byllesby & Co., H. M.
Central Station Engineering Co.
Electrical Engineers' Equipment Co.
New England Engineering Co.
Stone & Webster Eng. Corp.
White Companies, J. G.

CONTROLLERS, Printing Press.
Allis - Chalmers Manufacturing Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.

CONVERTERS, ROTARY.
Northwestern Electric Co.

COOKING DEVICES, Electric.
Cutler-Hammer Mfg. Co.
Despatch Mfg. Co.
Federal Sign System (Electric).
General Electric Co.
Hughes Electric Heating Co.
Manhattan Electrical Supply Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

COPPERS, Battery.
Manhattan Electrical Supply Co.
Stanley & Patterson.
Western Electric Co.

CORD, Braided.
Samson Cordage Works.

CRANES AND HOISTS.
Allis - Chalmers Manufacturing Co.
Jordan Bros., Inc.
Sprague Electric Works.

CRANE MOTORS.
Crocker-Wheeler Co.
Ft. Wayne Electric Works.
General Electric Co.
Triumph Electric Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CROSS ARMS (Wood).
American Bridge Co.
Bissell Co., F.
Humbird Lumber Co.
Lindsley Brothers Co.
Southern Exchange Co.

CURLING IRONS, Electric.
Central Elec. Co.
Manhattan Electrical Supply Co.
Simplex Electric Heating Co.

CUT-OUTS, Enclosed Fuse, Plug, Combination Rosette, Cut-Out Bases.
Central Electric Co.
Chicago Fuse Mfg. Co.
Commonwealth Edison Co.
D & W Fuse Co.
Detroit Fuse & Mfg. Co.
General Electric Co.
Hart Mfg. Co.
Johns-Manville Co., H. W.
Jordan Bros., Inc.
Manhattan Electrical Supply Co.
Multi Refillable Fuse Co.
Paiste Co., H. T.
Pass & Seymour, Inc.
Trumbull Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CUT-OUTS, Arc Light.
Brady Electric Mfg. Co.
Cutter Co., George.
Fort Wayne Electric Works.
General Electric Co.

CUT-OUTS, Transformer.
Central Electric Co.
D & W Fuse Co.
Delta-Star Electric Co.
General Electric Co.
Pass & Seymour, Inc.
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.

CUTTERS, PIPE.
Borden Company, The

DAMS, MOVABLE.
American Bridge Co.

DECORATIVE LIGHTING.
Central Electric Co.
General Electric Co.
Manhattan Electrical Supply Co.

DERRICKS.
American Bridge Co.

DIE STOCKS.
Borden Co., The.

DIRECT MOTOR DRIVES.
Crocker-Wheeler Co.
Electric Controller & Mfg. Co.
General Electric Co.
Triumph Electric Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

DOOR SWITCHES.
Cutler-Hammer Mfg. Co.
Cutter Co.
Hart Mfg. Co.

DRILLS AND BITS, Electricians'.
Cincinnati Tool Co.
Morse Twist Drill & Machine Co.
Hubbard & Co.
Orr & Lockett Harware Co.

DRINK MIXERS, Motor Driven.
Hamilton-Beach Mfg. Co.

ELECTRIC VEHICLES.
General Vehicle Co.

ELECTRODES, Furnace.
National Carbon Co.

ELECTRO - PLATING MACHINERY.
Crocker-Wheeler Co.
Ft. Wayne Electric Works.
General Electric Co.
Sprague Electric Works.
Westinghouse Electric & Mfg. Co.

ENGINEERS & CONTRACTORS.
American Bridge Co.
Arnold Co.
Badt-Westburg Electric Co.
Byllesby & Co., H. M.
Dixon-Smith Engineering Co.
Electrical Engineers' Equipment Co.
Ford, Bacon & Davis.
Foshay, Wilbur B.
Jackson, D. C. & W. B.
Lyndon, Lamar.
Lloyd-Thomas Co.
McMeen & Miller.
New England Engineering Co.
Nichols & Gilbert.
Norton & Bird.
Pillsbury, Chas. A.
Sargent & Lundy.
Stone & Webster Engineering Corporation.
Turner Improvement Co., J. W.
Western Electric Co.
White Companies, J. G.
Woodmansee & Davidson, Inc.

ENGINES, Gas and Gasoline.
Allis - Chalmers Manufacturing Co.
Westinghouse Machine Co.

ENGINES, Steam.
Allis - Chalmers Manufacturing Co.
Ridgway Dynamo & Engine Co.
Westinghouse Machine Co.

EXTINGUISHERS, Fire.
Johns-Manville Co., H. W.
Pyrene Mfg. Co.

FANS, Motor and Disc.
Central Electric Co.
Century Electric Co.
Colonial Fan & Motor Co.
Crocker-Wheeler Co.
Diehl, Mfg. Co.
Emerson Electric Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Hamilton-Beach Mfg. Co.
Manhattan Electrical Supply Co.
Peerless Electric Co.
Robbins & Myers Co.
Sprague Electric Works.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FAULT FINDERS, Electric.
Electric Controller & Mfg. Co.

FIREPLACES, Electric.
General Electric Co.
Westinghouse Electric & Mfg. Co.

FITTINGS, Conduit Terminals, Bushings, Entrance Caps.
Frorup & Co., L. E.
National Metal Molding Co.
Paiste Co., H. T.
Sprague Electric Works.

FIXTURES, Electric and Gas.
Beardslee Chandelier Mfg. Co.
Benjamin Electric Co.
Central Electric Co.
Delta-Star Electric Co.
Faries Mfg. Co.
Federal Sign System (Electric).
Post-Glover Electric Co.
Tungstolier Works of General Electric Co.
Western Electric Co.

FIXTURES, Indirect Lighting.
Central Electric Co.
Federal Sign System (Electric).

FIXTURES, Show Case.
Benjamin Electric Mfg. Co.
Central Electric Co.
Johns-Manville Co., H. W.

FLASHERS, Sign.
Bissell Co., F.
Campbell Electric Co.

FLAT IRONS, Electric.
Central Electric Co.
Current Electric Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Manhattan Electrical Supply Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FLEXIBLE SHAFTS.
P. R. Manufacturing Co.

FLUXES, Soldering.
Blake Signal & Mfg. Co.
Burnley Battery & Mfg. Co.
Chicago Fuse Mfg. Co.
Johns-Manville Co., H. W.
McGill Mfg. Co.
Manhattan Electrical Supply Co.
Western Electric Co.

FORGINGS.
American Bridge Co.

FURNACES FOR HEATING SOLDERING IRONS.
Current Electric Co.

FUSE PLUGS.
Anderson Mfg. Co., Albert & J. M.
D & W Fuse Co.
General Electric Co.
Johns-Manville Co., H. W.
Stanley & Patterson.
Westinghouse Elec. & Mfg. Co.
Western Electric Co.

FUSE WIRE.
General Electric Co.
Western Electric Co.

FUSES.
Central Electric Co.
Chicago Fuse Mfg. Co.
D & W Fuse Co.
Delta-Star Electric Co.
Detroit Fuse & Mfg. Co.
Economy Fuse & Mfg. Co.
General Electric Co.
Johns-Manville Co., H. W.
Monarch Refillable Fuse Co.
Multi Refillable Fuse Co.
Westinghouse Electric & Mfg. Co.

GATES, HEAD.
American Bridge Co.

GEARS, Rawhide and Composition.
General Electric Co.
New Process Gear Corp.

GENERATORS.
Allis - Chalmers Manufacturing Co.
Crocker-Wheeler Co.
Eck Dynamo & Motor Co.
Fort Wayne Electric Works.
General Electric Co.
Ridgway Dynamo & Engine Co.
Triumph Electric Co.
Wagner Elec. Mfg. Co.
Westinghouse Electric Mfg. Co.

GLASSWARE, Illuminating.
Central Electric Co.
Holophane Works of General Elec. Co.
Jefferson Glass Co.
Phoenix Glass Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

GLOBES, Arc Light. (Outer and Inner.)
General Electric Co.
Holophane Works of General Elec. Co.
Phoenix Glass Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

GRAPHITE.
Dixon Crucible Co., Joseph.
Holmes Fibre-Graphite Mfg. Co.

GRINDERS.
Hamilton-Beach Mfg. Co.
Wisconsin Electric Co.

GROUND CLAMPS.
Federal Sign System (Electric).
General Electric Co.
Hart Mfg. Co.
Mineralite Electric Co.
Paiste Co., H. T.
Sprague Electric Works.
Thomas & Betts Co.
Western Electric Co.

GROUNDING DEVICES.
Federal Sign System (Electric).
Dossert & Co.

GUARDS, Inc. Lamp.
Benjamin Electric Mfg. Co.
McGill Mfg. Co.

GUY CLAMPS.
American Steel & Wire Co.
Barnes & Kobert Mfg. Co.
Hubbard & Co.

HAIR DRYERS, Electric.
Central Telephone & Elect. Co.
Hamilton-Beach Mfg. Co.

HANGERS, Conduit and Moulding.
Mineralac Electric Co.
Western Electric Co.

HANGERS AND CLAMPS.
Bissell Co., F.
Mineralac Electric Co.
Ostrander & Co., W. R.
Pass & Seymour, Inc.
Sprague Electric Co.
Standard Underground Cable Co.
Thomas & Betts Co.

HEATERS, Electric.
Current Electric Co.
Cutler-Hammer Mfg. Co.
Despatch Mfg. Co.
Jubilee Elec. Co., Inc.
General Electric Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

HEATING SYSTEMS, Exhaust Steam.
American District Steam Co.

HOISTING MACHINERY, Electric Mine.
Allis - Chalmers Manufacturing Co.
General Electric Co.

HOUSES, Pole or Pilot.
Bissell Co., F.

HYDRAULIC MACHINERY.
Allis - Chalmers Manufacturing Co.

INSTRUMENTS.
Bristol Co.
Electric Controller & Mfg. Co.
Esterline Co., The.
Fort Wayne Electric Works.
General Electric Co.
Hoyt Electrical Instrument Co.
Johns-Manville Co., H. W.
Leeds & Northrup Co.
Manhattan Electrical Supply Co.
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

INSULATING CEMENTS.
Westinghouse Electric & Mfg. Co.

INSULATING MACHINERY.
New England Butt Co.

INSULATING PAINTS AND COMPOUNDS.
Chicago Mica Co.
Johns-Manville Co., H. W.
McGill Mfg. Co.
Mica Insulator Co.
Packard Electric Co.
Sherwin-Williams Co.
Standard Paint Co.
Standard Underground Cable Co.
Westinghouse Electric & Mfg. Co.

INSULATION, Hard Rubber Composition, Etc.
General Bakelite Co.
Hemming Mfg. Co.
Scranton Button Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, Arc Lamp.
Anderson Mfg. Co., Albert & J. M.
Cutter Co., George.
General Electric Co.
Johns-Manville Co., H. W.

CLASSIFIED INDEX—Continued

Westinghouse Electric & Mfg. Co.

INSULATORS, Glass.
General Electric Co.
Hemingray Glass Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, High Voltage.
Electrical Engineers' Equipment Co.
Electrose Mfg. Co.
General Devices & Fittings Co.
General Electric Co.
Johns-Manville Co., H. W.
Ohio Brass Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, Wood.
Westinghouse Electric & Mfg. Co.

IRIDIO-PLATINUM.
Baker & Co., Inc.

JARS, Battery (Glass).
Hemingray Glass Co.

JOINTS, Cable.
Dossert & Co.
General Electric Co.

JOINTS, Fixture Insulating.
Faries Mfg. Co.
Federal Sign System (Electric).
Thomas & Betts Co.

KITCHEN CABINETS.
Federal Sign System (Electric).

LABORATORY EQUIPMENT.
Meliorate Mfg. Co.
States Co.

LACQUER, Metal.
General Bakelite Co.

LAMPS, Arc.
Anderson Mfg. Co., Albert & J. M.
Central Electric Co.
Fort Wayne Electric Works.
General Electric Co.
Koerting & Mathiesen.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LAMPS, Incandescent.
Aetna Lamp Co.
Central Electric Co.
Deuth & Co.
Eastern Electric Lamp Co.
Franklin Electric Mfg. Co.
Kennedy-Webster Co.
Kentucky Electrical Co., Inc.
Independent Lamp & Wire Co.
Johns-Manville Co., H. W.
Laco-Phillips Co.
Lux Mfg. Co.
National Lamp Works of General Electric Company, comprising the following member divisions:
American Electric Lamp Division.
Banner Electric Division.
Boston Economy Lamp Division.
Brilliant Electric Division.
Bryan-Marsh Electric Division.
Buckeye Electric Division.
Colonial Electric Division.
Columbia Incandescent Lamp Division.
Economical Electric Lamp Division.
Elux Miniature Lamp Division.
Federal Miniature Lamp Division.
Fostoria Incandescent Lamp Division.
General Incandescent Lamp Division.
Monarch Incandescent Lamp Division.
Munder Electric Division.
Packard Lamp Division.
Peerless Lamp Division.
Shelby Lamp Division.
Standard Electric Division.
Sterling Electric Lamp Division.
Sunbeam Incandescent Lamp Division.
New York Incandescent Lamp Co.
Western Electric Co.
Westinghouse Lamp Co.

LAMPS, Vapor and Vacuum Tube.
Cooper Hewitt Electric Co.
General Electric Co.

LIGHTING PLANTS.
Crocker-Wheeler Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

LIGHTNING ARRESTERS.
Anderson Mfg. Co., Albert & J. M.
Central Electric Co.
Delta-Star Electric Co.
General Electric Co.

LIGHTS, Desk.
Faries Mfg. Co.
Federal Sign System (Electric).
Johns-Manville Co., H. W.
Stanley & Patterson.

LIGHTS, Stage.
Bissell Co., F.
Campbell Electric Co.

LINE MATERIALS.
Anderson Mfg. Co., Albert & J. M.
Central Electric Co.
General Electric Co.
Hubbard & Co.
Johns-Manville Co., H. W.
Line Material Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LOCOMOTIVES, Electric.
General Electric Co.
Westinghouse Electric & Mfg. Co.

LUBRICANTS.
Dearborn Chemical Co.
Dixon Crucible Co., Joseph.

LUGS.
Chicago Fuse Mfg. Co.
Delta-Star Electric Co.
Dossert & Co.
Electrical Engineers Equipment Co.
General Devices & Fittings Co.
Meliorate Mfg. Co.
Multi Refillable Fuse Co.
Trumbull Electric Mfg. Co.

MAGNETIC SWITCH CONTROLLERS.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Sundh Electric Co.

MAGNETOS, MAGNETO-GENERATORS AND BELLS.
Manhattan Electrical Supply Co.
Western Electric Co.

MAGNETOS, Ignition.
General Electric Co.
Manhattan Electrical Supply Co.

MAGNETS, Electro.
Belden Mfg. Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Manhattan Electrical Supply Co.
Sundh Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

MAGNETS, Lifting.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Independent Electric Mfg. Co.
Sundh Electric Co.
Western Electric Co.

MAGNETS, Permanent.
Esterline Co., The.
Western Electric Co.

MARINE FIXTURES.
Benjamin Electric Mfg. Co.
Delta-Star Electric Co.
General Electric Co.

MAST ARMS.
Brady Electric Mfg. Co.
Cutter Co., George.
Fort Wayne Electric Works.
Pittsburgh Transformer Co.

MEASURING MACHINES (For Wire Measuring).
Minneapolis Electric & Construction Co.
New England Butt Co.

METERS, Recording.
Bristol Co.
Esterline Co., The.
General Electric Co.

MICA.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

MINING MACHINERY (Motor Driven).
Allis - Chalmers Manufacturing Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

MOLDED INSULATION.
Cutler-Hammer Mfg. Co.
General Bakelite Co.
Hemming Mfg. Co.
Scranton Button Co.
Westinghouse Electric & Mfg. Co.

MOTORS AND DYNAMOS.
Allis - Chalmers Manufacturing Co.
Central Electric Co.
Century Electric Co.
Clark Electric Co., Jas., Jr.
Colonial Fan & Motor Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Eck Dynamo & Motor Co.
Emerson Electric Mfg. Co.
Ft. Wayne Electric Works.
General Electric Co.
Hamilton-Beach Mfg. Co.
Kentucky Electrical Co., Inc.
Lincoln Electric Co.
Peerless Electric Co.
Richmond Electric Works.
Ridgway Dynamo & Engine Co.
Rittenhouse Co., A. E.
Robbins & Myers Co.
Sprague Electric Works.
Triumph Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
Wisconsin Electric Co.

MOULDING.
National Metal Molding Co.
Paiste Co., H. T.
Stanley & Patterson.
Trumbull Electric Mfg. Co.

OZONIZERS.
Federal Sign System (Electric).
General Electric Co.

PACKING, Steam.
Johns-Manville Co., H. W.
New York Insulated Wire Co.

PAINTS, Preservative.
Dixon Crucible Co., Joseph.
Johns-Manville Co., H. W.
Standard Paint Co.
Western Electric Co.

PATENT SOLICITORS.
Duvall, Edw. S.
Siggers, E. G.

PHOTOMETERS, Lamp Testing.
Leeds & Northup Co.

PHOTOMETER STANDARDS.
Electrical Testing Laboratories.

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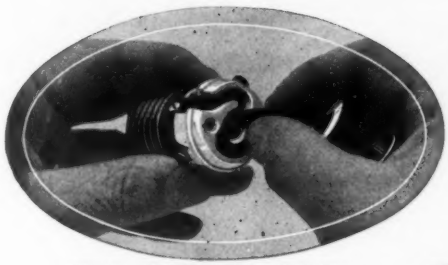

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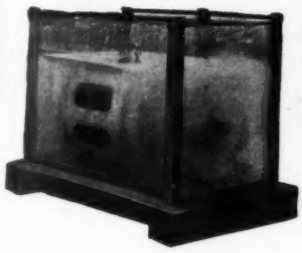

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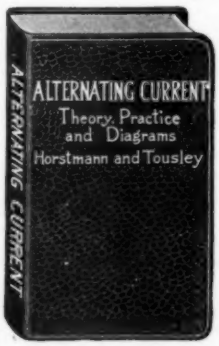

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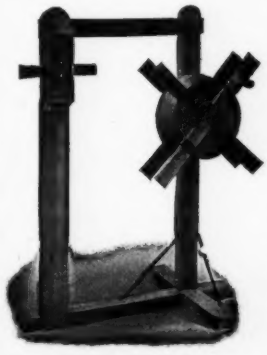

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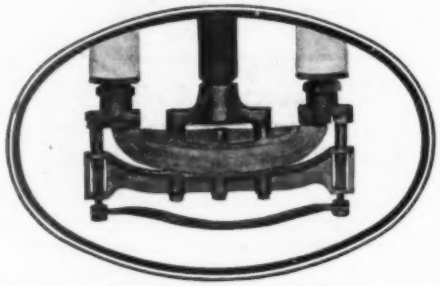

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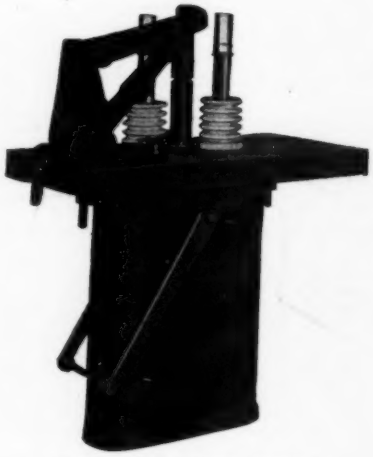

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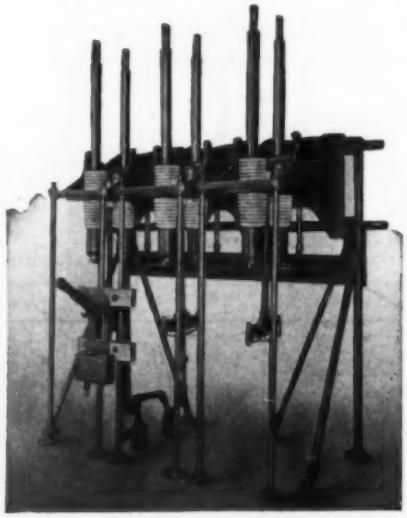

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